ENVIRONMENTALLY PROTECTIVE AGRICULTURAL PRACTICES: A SPATIAL ANALYSIS OF THE CATTLE AND CALF INDUSTRY OF FLORIDA

By

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My graduate education began with meeting Dean Roderick McDavis. He saw something in me that took a few years to evolve. Dean McDavis, has helped and directed me in ways I have yet to ascertain. This doctoral portion of my educational process would not have been possible without the support, knowledge, guidance, honesty, and regard of Dr. Caviedes, my committee chair. The academicians that follow, not at all fall into a subordinate standing. They are the components that brought me to this point in my educational voyage; Dr. H.T. Odum for introducing me to a systems approach, an important tool used to explain complex interactions, Dr. Joann Mossa has shown that hard work is the way to excellence and at the very same time, life can be "normal", Dr. Timothy Fik for sharing his enthusiasm for knowledge, Dr. Marilyn "Micki" Swisher for demonstrating that the path to success is navigated by reaching for what seems to be impossible, Dr. Weismantel for being an essence of encouragement applied at the right time to succeed in this process.

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Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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Chairperson: Dr. Cesar Caviedes
Major Department: Geography

The Florida livestock cow and calf producers are reviewed in terms of its environmentally protective practices. Utilizing a Florida cattle rancher survey conducted in 1993, cattle ranching is perceived as an agricultural practice that is capable of safeguarding Florida's natural environment and face the future in a satisfactory manner.

Florida ranchers were asked how important political and economic factors are to the future of Florida ranching. Their responses revealed that Florida ranchers are well informed of the external forces that affect their industry. Results indicate that cattle ranchers in Florida believe they are

using many cow/calf production practices which are environmentally benevolent. The data also indicate that they are concerned about the potential impacts of environmental issues and government regulation on both individual ranch profitability and the future of ranching in the state. Unfortunately, results also show that most ranchers are probably not monitoring their ranch operations effectively to prove that their operations are environmentally sound.

Nevertheless, fierce competition for land resources exists throughout Florida and affects cattle ranching. Urbanization is expanding the MSA areas in a manner that will make it necessary to impose legislation to control land consumption. Also other forms of agricultural exploitation are encroaching on the land formerly utilized by cattle ranching. Both herd size and surface covered with natural or improved pastures are changing and this change is more dramatic in southern counties than in northern counties.

CHAPTER 1

LOCATION OF THE COW/CALF INDUSTRY IN FLORIDA'S AGRICULTURE

Introduction

Cattle production in Florida is essentially a cow/calf operation; its amplitude is indicated by the number of breeding cows, often called brood cows (1,083,000 in 1990), and the acreage of pasture (over 11 million acres in 1990 reported by The United States Department of Agriculture, 1990). The cow/calf operation produces calves to be sent to finishing yards in the western part of the United States. These calves are later sold to stock yards for butchering and dressing. Florida provides the largest brood cow population in the country while supplying a significant number of calves for finishing.

Maintenance and management of range land in Florida are vital for wildlife and water recharge. Because pastures and other forages occupy so much land in Florida, this study will look into the theoretical and practical association between the cow/calf industry and patterns of land use in the state. The study infers that Florida cattle ranchers use management practices that incorporate an understanding of ecological

principles to protect the use of watersheds and wildlife habitat and that, therefore, the Florida cattle industry is conceptually a "sustainable" agricultural practice.[1]

This study will also examine how cattle ranchers use and manage their land. Wise use and management of these lands can go far toward meeting the goal of sustainable resource use. Contributions to this body of knowledge are therefore important both from a conceptual and from an applied perspective.

The concept of sustainable agriculture requires a thorough understanding of the food, fiber, and fuel production processes, including their impact on and interactions with natural ecosystems and their social implications. There is a need for a comprehensive study of agricultural production systems in the state, in general, and livestock production systems specifically. This project explores the principles of ecological management of livestock production systems and other systems, such as natural forests and natural preserves, to help determine the degree to which Florida ranchers understand and use sustainable agricultural technology.

Some contend that any conversion of natural land to pasture and range leads to ecosystem deterioration and loss of biodiversity to a significant degree. They assume that high-

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[1] The terms sustainable and sustainability will adopt different connotations in the course of this dissertation. The quantitatively appropriate phrase, "environmentally protective" is mostly applicable.

intensity, confinement systems inevitably produce large scale resource degradation. These systems, however, have traditionally not applied to the Florida cattle industry. Other authors hold the view that only traditional systems, in which livestock, crop, and forage production are highly integrated, can be considered sustainable (Swisher et al., 1994; Maikhuri, 1992). To some, "sustainability" means a change from present agricultural methods to the implementation of completely organic, low input, low impact agriculture.

All the data concerned with the adoption of environmentally protective agricultural practices comes from a survey of cattle and calf producers conducted in Florida in 1993. The data assembled in the survey suggest that Florida cattle ranching could be considered a sustainable agricultural activity from a qualitative and conceptual perspective. The data also demonstrate that ranchers are aware of the environment and take responsibility for its conservation. Three critical environmental concerns for Florida ranching are nutrient management, pest management, and water conservation. Data for all three areas of concern were collected. Furthermore, economic forces dictate that both the biological and economic productivity of farms and ranches must be maintained and that environmental impacts must be minimized to assure social compatibility (Lightfoot and Nobel, 1993).

The concern for environmental problems and the need for wise resource management and land utilization created an interest in developing sustainable agricultural production systems from a conceptual viewpoint. The preocupation with maintaining farming systems that are environmentally sound has gone so far that "sustainability" is one of the goals targeted in the 1990 United States Farm Bill. The United States Department of Agriculture expressed this concern and defined the involvement of the federal government in sustainable agriculture. However, it was the environmental movement that forced the agricultural community and society in general to look at the application of a viable "sustainable agricultural methodology." The United States Department of Agriculture has stated that an agricultural system that meets needed economic and production levels and, simultaneously works in harmony with the present existing ecosystems is a "sustainable agricultural methodology."[2]

The term "sustainable agriculture" as it pertains to Florida cattle ranching implies using ranching practices that

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[2] The definition of sustainablity used in this study comes from the 1990 Food, Agriculture, Conservation and Trade Act, Subtitle A , Title XVI. It is defined as follows:

Sustainable agriculture is an integrated system of plant and animal production having a site specific application that will, over the long term, satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends; make the most efficient use of non-renewable resources and of farm/ranch resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm/ranch operations; and enhance the quality of life for farmers/ranch operation; and enhance the quality of life for farmers and society as a whole.

will help meet the state's agricultural economic needs while protecting delicate natural ecosystems and maintaining the state's natural resource base (De Haven et al., 1991). "Absolute sustainability" may never be achieved. However, it is necessary that farmers, ranchers, and others seek and utilize agricultural practices that approach acceptable levels of sustainability (Swisher et al., 1995).

Too often, the impression is given that all livestock production occurs in intensive confinement systems. Insufficient studies have been conducted on the degree to which ranchers who use pasture based systems, such as those in Florida, are environmentally protective. Inconclusive results, based on the characteristics of production systems that are not typical of cattle production in Florida, have unsupported conclusions about the negative effects of Florida livestock systems. This study of Florida ranching activities also incorporates a geographical perspective. A location coefficient is used to explain the relationships between land resources, cattle ranching, and population. Some historical background is also necessary to place "sustainability" in an accurate time framework that allows the assessment of environmental change and provides a starting point for the measurement of the transformation of agricultural enterprises.

Intent and Objectives

This dissertation concentrates on four research objectives:

Objective 1

The first objective is to present a demographic profile of cattle ranchers and a picture of the basic characteristics of cattle ranches and their operators, to understand their role and place in Florida's agriculture.

Objective 2

The second objective is to describe changes in the practices used in cattle ranching between 1983 and 1990. This includes assessing the degree to which cattle ranchers use practices that are environmentally protective. It is assumed that major changes are occurring within this activity.

Objective 3

The third objective is to examine the opinions of cattle ranchers and to determine the degree of connection of cattle ranchers with the scientific community, to understand the external forces that control cattle ranching as an economic activity. Factors that affect the profitability of cow/calf production such as taxes, regulations, and record keeping are assessed. One goal is to characterize the perceptions of

cattle ranchers towards government and to reveal their attitudes regarding the adoption of environmentally protective agricultural practices.

Objective 4

The fourth objective focuses on the location of cow/calf production in the state and the ways these enterprises relate to other uses of land. Particularly important in this fourth objective is the growing pressures placed on ranching land by use for human habitation. Many areas of Florida are experiencing rapid population expansion and agricultural shifts. With the prospect of declining environmental amenities and economic utility derived from the natural resource base, Florida will have to make some very tough decisions in future years. This dissertation presents a geographic framework of this competition for land and discusses the rate of land use conversion by using land use coefficients and location quotients. Evidence suggests that differential land conversion occurs as a result of growth in urban areas and in the areas used for cattle ranching. If a pattern of land consumption is established, future land conversion can be predicted, and better judgments can be made about attempting to restrict land use change.

CHAPTER 2

FLORIDA CATTLE RANCHING AND ENVIRONMENTALLY PROTECTIVE PRACTICES: A LITERATURE REVIEW

Florida's population increased from 9,746,925 inhabitants to approximately 12,937,922 between 1987 and 1990. During the same period, the value of Florida's agricultural products also increased. Despite periodic freeze damage to citrus and other crops (Weischet and Caviedes, 1987), the value of cash receipts from all farm commodities produced in Florida rose by 23 percent between 1984 and 1988 to over $5.8 billion (Jackson et al., 1995). During this period, cash receipts of all agricultural products in the U.S. grew by only 6 percent. By 1988, Florida was eighth in the U.S. for cash receipts of agricultural commodities. Both the area in agricultural production and the area devoted to urban development have grown. This growth has an economic and an environmental price tag.

This chapter reviews the trends in cattle and calf production in the state and describes the environmental concerns associated with ranching. To the average American,

who is at least several generations off the farm, mental recollection of a farm most often includes livestock.

Today this image is mostly a sentimental image because farms have typically specialized into either crops or livestock. For example, in Florida farm numbers have decreased at a rate of nearly 140 farms per year since the early 1960s. The number of farms with cattle declined by 260 farms in 1980, nearly twice the 1960 rate (U.S. Department of Agriculture, 1993). The most significant change is that the farms remaining are fewer, larger, and mostly crop-only operations. Economic and social changes over the past century have greatly affected the presence of livestock in agrosystems. Economies of scale and the associated transportation costs were the foremost reason for concentrating the livestock finishing industry in the central region of the United States. Meat-packing plants were built alongside the rail centers in Kansas City and Chicago to ease access for the incoming cattle and the outgoing carcasses. The livestock finishing industry is still largely controlled by these strong economic influences. Feed lots have dominated southwest Kansas and the southern High Plains. The largest packing plants are now located near the feed lots, to allow shipping of boxed beef rather than live cattle. The economy of packing and delivering the highest quality, most uniform, and cheapest meat products to consumers

has thus changed the distribution of livestock across the country. Calves are raised in Florida and other regions of the South and are then shipped to midwestern regions for finishing.

Social factors have further separated livestock from the other farm endeavors. With the arrival of larger tractors and tools supporting the work demands of larger farms and fields, mechanization of the entire farm has been an appealing notion to the agriculturalist. Depending on the type of operation, livestock require care throughout the year. Although cattle has remained a part of the romantic image of western agriculture, they no longer fit the mold of a contemporary farm. There are also other social factors that have discouraged meat consumption. Health concerns about animal fats, animal rights concerns, and animal welfare issues, whether perceived or real, have had a negative impact on the livestock industry.

Although agroecosystems are possible without livestock, domesticated animals have long been perceived as consumers in the agroecosystem (Joandet and Cartwright, 1975). Ruminants have the most potential to diversify and re-diversify the agroecosystem because they use forage based rations. Livestock production that is concentrated on the use of high quality feed grains is not a Florida process. Yet, switching from

grain based to forage based rations has widespread implications for both the livestock industry and the farm (Wedin et al., 1975). Even the recent attention to organic farming methods has aroused criticism in that it would require too many head of cattle (Bender, 1988). The enhanced use of livestock to enrich the perspective agroecosystem thus seems confined by rigid economic and social constraints.

Consensus has developed in support of the use of modern technologies to raise productivity on farms. However, the newly introduced technologies should not degrade the natural resource underpinnings. These technologies should offer benefits to all segments of society now and into the future (Brklacich et al., 1991; O'Connell, 1991; Trenbath et al., 1990; Douglass, 1984; Fox, 1991; Miller, 1992; Carter, 1992).

Perhaps the considerable interest in environmentally protective systems is due to the fact that the United States Department of Agriculture (USDA) has sponsored research on low input sustainable agriculture (LISA). Farmers and researchers are interested in responding to an observed desire of consumers for healthier food and more environmentally sound production practices. Being sensitive to market demands is just good business sense. The research establishment that supports lower input technologies, marketable alternative

crops, and processes has added sustainable agriculture to its research agenda.

Whatever reasoning is behind the appeal of sustainable agriculture, one can not help but foresee a profound revolution about to overtake American agriculture. The basis for assuming that some of our present livestock production and resource management practices are not at all sustainable will be examined further. However, the extent of any assumed "revolution" in agriculture will depend on what one clearly understands by "sustainability."

Economic, social, political, and ideological influences continuously constrain or divert people and institutions from acting on what are fitting obligations. Gordon Douglass (1984) has discerned three different uses of the term "sustainable agriculture" in recent literature:

1) as a long-term food sufficiency, either domestic or worldwide;
2) as an agricultural system that preserves and conserves renewable and nonrenewable resources; or
3) as a set of agricultural procedures that encourage certain values and strengthen the vitality of local communities.

With these connotations in mind, the evolution of an ecological consciousness that we call "sustainability" is outlined further below.

The Accepted Government Definition of Sustainability

The 1990 Food, Agriculture, Conservation and Trade Act provides a working definition of "sustainable agriculture" as mentioned earlier. It is clear that the United States government assumption is that sustainable production systems are integrated systems that are site-specific and that will satisfy human food and fiber needs over the long term.

The 1990 United States Farm Bill goes on to say that these systems should enhance the quality of the natural resource base. They should make the most efficient use of both nonrenewable and on-farm resources and should sustain the economic viability of the farm or ranch while enhancing the quality of life for both farmers and society as a whole.

In Florida, studies that evaluate agriculture's adoption of sustainable practices have been performed. Studies conducted in 1982 by the Florida Cooperative Extension Service concerning beef forage practices and the 1986 Florida Cooperative Extension Service research focusing on beef-forage practices in South Central Florida address some environmental issues involved in cattle and calf production (Swisher, 1993).

Most importantly, these surveys provide information about ranchers' fertilization practices, suggesting that ranchers use low nitrogen and phosphorus application rates, reducing their potential for nutrient discharge into surface and ground water supplies. These studies, however, do not address water or crop pest management practices among Florida ranchers. University of Florida researchers conducted a study of management practices, particularly water and nutrient management practices, among fern producers a subset of the ornamental industry, (Swisher,1993).[1]

In 1992 the University of Florida completed a study centering on the Suwannee River Basin, and particularly on dairy farmers' attitudes towards water quality (Taylor, 1992). Some argue that the generalized concept of "sustainability" also involves social equity issues such as accessibility of technology and information. This has been the case for the small or resource-poor farmers (Conway, 1987; Lele, 1991; Smith, 1980; Swisher, 1993). Also stated is the need to manage

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[1] This researcher goes on to identify other research projects:

> A 1988 study by Ridgley (1992) addresses growers adoption of integrated pest management practices for soybean production. The results of this study provide detailed information about pest management practices among soybean growers. However, soybean acreage is small in Florida and this study does not provide insights in to nutrient or water management. A very detailed study of citrus production practices was conducted in 1989 (Taylor, 1992). This study provides a wealth of information and addresses water, nutrient, and pest management practices. Also of interest is a study of integrated pest management practices among organic vegetable producers (Swisher, and Monaghan, 1995).

resources wisely to assure equity and provide future generations with better options (Howarth and Norgaard, 1990).

Adoption of Environmentally Protective Agricultural Practices

The question of the social consequences of technological change -- for example, who wins and who loses -- has haunted much of the academic and political debate over science and technology. A generally optimistic attitude towards technological change prevailed during the fifties and sixties. This optimism was based on the linear diffusionist model of science and on the belief that the diffusion of science and technology into a social system would invariably produce progress. Post-classical diffusion formulations in the eighties shifted substantial focus from adoption to the diffusion interests of propagators in order to explain uneven effects and consequences of technological change. Given the reduced degree of political support for the linear diffusionist model that science had enjoyed, technological innovations have remained relatively slow in adoption.

Many authors, this researcher included, argue that sociological attributes, such as age, gender, and educational level (Lockeretz, 1991), including social status, membership in organizations, and contact with extension and other

institutions serve best to predict adoption behavior. Even the influence of such physical skills as mechanical dexterity on adoption behavior has been hypothesized (Reynolds and Dillman, 1991). Some researchers emphasize the influence of commitment to sustainable techniques on adoption behavior (Buttler et al., 1991, Lynne et al, 1988; Nassauer and Westmacott, 1986).

There are five groups (farmers and other potential adopters of new technologies) that are distinguished by their abilities to accept "new" techniques. The groups are: innovators, early adopters, adopters, late adopters and laggards (Swisher, 1993). These groups are described primarily based on their individual characteristics. Innovators, for example, are typically characterized as younger, with higher educational levels, and having more intensive and more frequent contact with sources of information in both the public and private sector.

None of these constructs considers the importance of regulations, scarcity of inputs, and farmer awareness of public opinion in farm decision-making, therefore creating an incomplete representation of the situation. Although some attention is now paid to exogenous factors (Green, 1986), traditional models of predicting utilization of sustainable agricultural technology continue to frequently assume that farmers freely choose to adopt or reject a particular practice

or technology. Yet, the farmers' decision-making power is increasingly constrained by exogenous factors. Regulatory agencies, such as the Water Management Districts in Florida, may, for example, dictate that farmers reduce input use. Farmers fear the legal consequences of surface and groundwater contamination from nutrient application. Yet, studies on the role of ranchers' perception of regulation and public opinion are absent from the literature.

The degree to which livestock production systems, particularly cattle production systems, are sustainable or can be made sustainable has been controversial. Several arguments are offered that basically assume that modern livestock production systems are, by their nature, inherently not sustainable over the medium to long term (Swisher, 1993). Expansion of ranching and the accompanying conversion of natural ecosystems to pasture and other forage lands, has been blamed for extensive environmental degradation and loss of biodiversity. Menke and Bradford (1992) indicate that nearly 50 percent of the earth's land area is in rangeland. Nations and Nigh (1978) were some of the earliest and most vocal critics of the role of ranching in tropical ecosystem destruction. They and others (Gradwohl and Greenberg, 1988; Buschbacher, 1986) have argued that ranching is a leading cause of forest destruction because it requires small

investment in capital and labor and has been subsidized by tax incentives in many states (Abt et al., 1990). While some argue that more intensive management of rangelands would reduce these kinds of destruction, Menke and Bradford (1992: 141) point out that "the greatest aspects on biodiversity usually occur on sites with the highest productivity." Intensive livestock production systems, based on confinement, obviously reduce the amount of destruction of habitat that non-intensive, open range systems incur. Other critics, however, argue that these systems have many undesirable impacts.

Extensive research in Florida and elsewhere has been conducted to prevent nutrient movement into ground and surface water supplies (Sutton et al., 1993; VanHorn et al., 1991; Gallaher et al., 1994). Although high capacity confinement systems obviously offer the greatest potential for liberating excess nutrients into water supplies, even livestock grazing systems are under scrutiny by EPA, primarily where access to sensitive places such as stream banks, wetlands, estuaries, ponds, lake shores and riparian zones by livestock can result in excess nutrient loading of water resources. These facilities are not part of the Florida livestock operation. Another argument against modern livestock production systems focuses on their role in society as a whole (Conway, 1987; Edwards, 1987; Youngberg, 1984). For example, livestock

production is criticized by some for using food grains that could be used to feed people.

Environmentally protective[2] practices in livestock production, particularly cattle ranching, are clearly important to the general sustainability of agricultural production in Florida. Both the extent of land use for beef production and the economic importance of this activity justify examining how well Florida's ranches meet the criteria for sustainability. The next section deals with land use, another component of sustainable agriculture which is frequently overlooked when evaluating the farmer's efforts to sustain agricultural activities. How is land use changing from intensive agricultural to urban uses? How are these changes measured and what is the cost associated with these changes?

Land for Urban Use Versus Land for Agricultural Use

Human settlement greatly affects the demand for agriculturally productive land. If recent migrants were only involved in agricultural activities, the land resources would be consumed in crop and/or livestock production activities. However, this is not the case in Florida. Land in Florida is

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[2] This dissertation assumes a thesis that defends the use of *environmentally protective* practices because the theory of *sustainability* has economic aspects, cultural implications and personal preferences that are <u>not</u> quantitative, and therefore are qualitative in measurement.

proportionately involved in urbanization and agricultural production and as a result quotients and coefficient measures are employed to examine settlement patterns.

Florida has been experiencing dramatic economic and demographic change in this century. The average land/resident ratio is greater than in other parts of the country (Florida Statistical Abstract, 1991). Population and industrial growth have also had more subtle impact on Florida land. In many areas, rural land has increasingly gone into the hands of nonresident, often urban, owners (Bureau of Economic and Business Research, 1989). The latter, who may have inherited the property or purchased it for recreation or as an investment, are often unwilling or unable to manage the land to its fullest potential. The management behavior of non-industrial private forest owners, for example, has frequently been identified as one of the greatest uncertainties for long-term forest management in Florida. The ownership problem is compounded by widespread division of land into smaller parcels (which created dis-economies of scale for almost any productive use) and by the interspersion of urban and rural land uses, to the detriment of both (Reynolds and Dollman, 1991).

Shifts in land use in Florida have produced significant environmental changes as well. Clearing bottom land hardwood

forests and groves to make way for truck crops has all but eliminated vast areas of wildlife habitat in several southern river systems (U.S. Forestry Service, 1980). Of the 2.4 million acres of forested wetlands originally located in the wetlands, nearly all cleared land has become cropland. Expansion of pasture onto forest is generally accompanied by an increase in soil erosion (Pritchard, 1966). Erosion not only threatens future soil productivity but contributes to water pollution and to silt buildup in watercourses and reservoirs. Competition for Florida land has also led to competition for Florida water (Southeast Water Resources, 1979). Average rainfall is relatively high in Florida compared to the West and parts of the Midwest. Yet the seasonal distribution of rainfall in the state in not optimal for crop production, and Florida farmers have learned that they can increase yields by irrigating. Intensified use of water in Florida has, thus far, had two side effects.

First, in several local areas pumping of groundwater by agricultural irrigators, but mostly by urban users, has lowered the water pressure within underground aquifers especially in the southeastern part of the state. This has resulted in the drying of wells, in some local areas, and has allowed saltwater to infiltrate into well fields, contaminating the water supply in a number of communities.

Second, there is growing interest in the ownership of water rights. In Florida, where historically there has been ample water for all, water users are becoming aware that they must establish some controls on water if they are to protect themselves from future shortages. The competition for settlement land use with other uses will be decided in part by the automatic operation of land and product markets. All of these factors are likely to continue to exert their influences in the years to come. It has been argued that the current lavish use of land in Florida for settlement activities (urbanization) is a consequence of the fact that the urban value of land is high relative to its value in other uses. But if urban and other residential uses of land begin to reduce significantly the agricultural land base, prices of crops and timber will rise. With higher product prices, agricultural and forestry users of land will be able to pay more to rent or buy land.

CHAPTER 3

THE BASIS OF FLORIDA AGRICULTURE AND THE LOCATION OF THE COW-CALF INDUSTRY

The agriculture of the state has developed successfully in the face of many unfavorable factors (United States Department of Agriculture, 1990). Under good management, a large volume of crop and livestock production is achieved.

Much of Florida has a subtropical climate with warm humid summers and receives and average of 60 to 70 percent of the maximum sunshine. Nonetheless, while it is particularly advantageous to the production of citrus fruits and winter vegetables, it also increases the hazards of plant diseases and insects. Variations of temperature within the state are distinct and are important to agriculture. In terms of average planting dates the state is divided into seven zones. The map of what is called "hardiness zones" (Figure 3.1) divides the state into seven temperature regions of mean annual minimum temperature *zones* revealing that much of the Southeast United States and, including, Florida is cooler in the winter than previously reported.

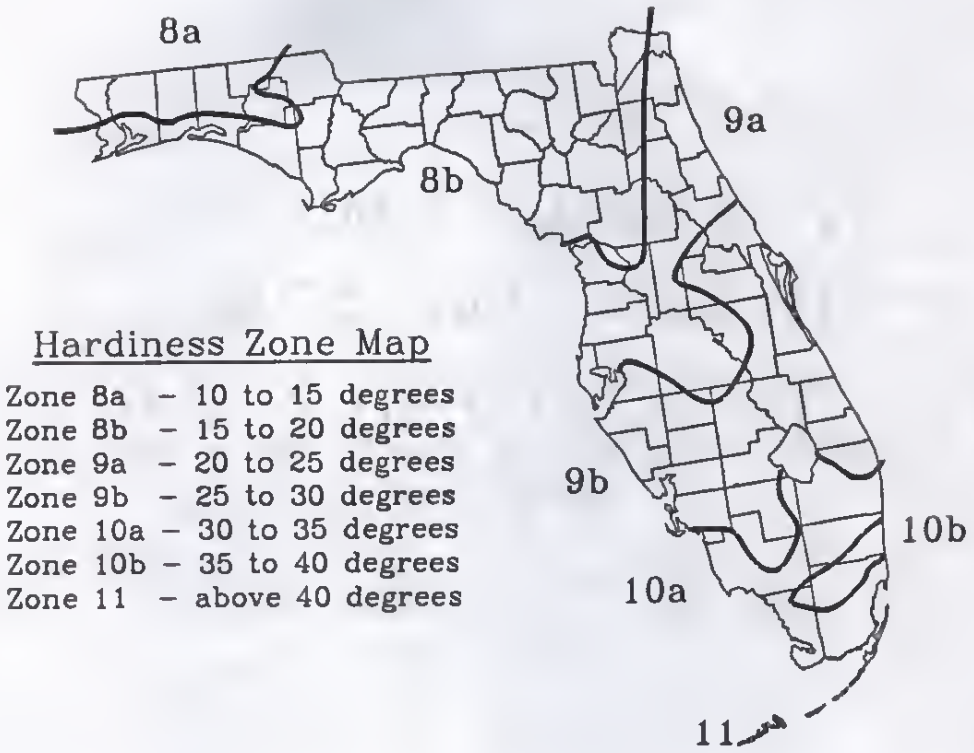

Figure 3.1 Hardiness zones. Source: The United States Weather Bureau, 1990.

The growing season tends to shorten as one goes inland from the coast toward the middle of the state. Cold waves are of short duration, rarely lasting more than three days. Though temperatures of 15 degrees to 20 degrees may be reached in the extreme north of the state, temperatures of 32 degrees or higher prevail in the southern part of the state. Half the land area of the state has a growing season that ranges from

240 to 310 days. The rest, excluding only the Lower Keys, has a growing season that ranges from 310 to 365 days.

Temperatures are especially important because their differences are reflected in the distribution of citrus and vegetable production (Table 3.1). Winter vegetables tend to be concentrated in southern Florida, whereas spring and fall vegetables are found in central and northern Florida. The major citrus producing areas are located south of the line that marks a normal annual temperature of 70 degrees (Jackson et al, 1995). Winter minimum temperatures offer a pattern that will assist in identifying the subtle variations in temperature throughout the state of Florida (Waylen, Chen and Gerber, 1986). The daily minimum temperature is the lowest temperature recorded for each day, it usually occurs at night or very early in the morning. This measure is important due to the fact that very low temperatures over a long period (a few hours in the case of citrus farming) are a danger to crops and plants by creating frost conditions. Frost is defined as the condition when the temperature reaches 32 degrees Fahrenheit or less. The monthly minimum temperature is an average of the daily minimum temperatures of each month. January is usually the coldest month of the year where most absolute minimum temperatures occur.

Table 3.1 Distribution of vegetable crops throughout the State of Florida (Modified from Marcus and Fernald, 1975).

1. **West**
   Escambia County: potatoes | Holmes, Jackson, Washington Counties: butter beans, field peas, watermelons | Gadsen County: pole beans, squash, sweet corn, tomatoes.
2. **North**
   Stake, Brooker, Lake Butler: lima beans, snap peas, cucumbers, peppers, squash, strawberries. Hastings: cabbage, potatoes | Gainesville: Alachua area: bush beans, cucumbers, peppers, potatoes, squash.
3. **North Central**
   Oxford, Pedro: tomatoes, watermelons | Sanford, Oviedo, Zellwood: cabbage, carrots, celery, sweet corn, cucumbers, escarole, greens, lettuce, peppers, radishes, spinach.
4. **West Central**
   Plant City, Balms: bush and pole peas, lima beans, cucumbers, eggplants, field peas, greens, squash, strawberries, cabbage, watermelon | Palmetto, Ruskin: cauliflower, squash, strawberries, cabbage, watermelon | Sarasota: cabbage, celery, sweet corn, escarole, lettuce, radishes.
5. **East Central**
   Fort Pierce: tomatoes, watermelon.
6. **South West**
   Fort Meyers, Immokalee: sweet corn, cucumbers, eggplant, peppers, potatoes, squash, tomatoes, watermelons.
7. **Everglades**
   bush beans, cabbage, celery, Chinese cabbage, sweet corn, escarole, greens, lettuce, potatoes, radishes.
8. **Southeast**
   Martin County: field peas, greens, cabbage, watermelons, tomatoes | Pompano Beach: cabbage, celery, sweet corn, radishes, egg plant, squash, tomatoes | Homestead: cauliflower, squash, strawberries, cabbage, watermelon, cucumbers, tomatoes.

Florida receives substantial precipitation (National Weather Service, 1990). Average rainfall totals vary from 40 inches in the Florida Keys to 55 to 65 inches on the mainland (Figure 3.2). The areas of highest rainfall are the extreme western counties and the interior southern peninsula, where annual totals range from 55 to 65 inches. Rainfall distribution through the year is uneven. In an average year the summer "rainy" season, extending from about June through September or early October, produces about 60 percent of the annual rainfall in the central and southern peninsula. The four months of the "rainy" season produces about 55 percent of the average of the northern peninsula and about 45 percent of the average in the western counties. On the central and northern peninsula, rainfall diminishes in September and is low in November. December through March is followed by marked dry periods in April and May (Winsberg, 1990). In the western counties, October and early November are the year's driest period. Rainfall usually increases again during February and March. Late April, May, and June are frequently dry, especially in the western counties.

Approximately two-thirds of the land area of the state has poor to very poor natural surface drainage (Marcus and Fernald, 1975). Runoff patterns are not well defined in the poorly drained areas. Excess water moves slowly through broad

sloughs into shallow lakes or sluggish streams and finally into the Gulf of Mexico or the Atlantic Ocean.

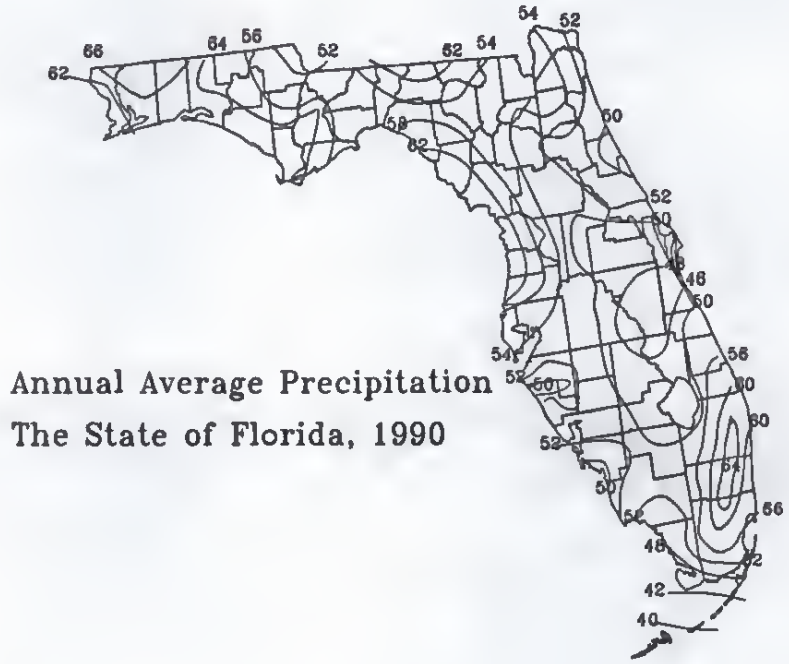

Figure 3.2 Mean average annual precipitation.
Source: United States Weather Bureau, 1990.

Drainage, water control, or both, are needed for crop production and, in some areas, are desirable or necessary for pasture production. Without control measures, large areas of lower lying lands are subject to constant flooding and cannot be used as grazing land.

Throughout the state, drainage is an important part of water control. This is due mainly to the uneven seasonal

distribution of rainfall. In wet seasons, it is crucial to remove water, while irrigation may be required during the dry seasons. Water control is therefore related to the inconvenience of removing excess water at certain times of the year and adding water in times of need. Drainage improvements that do not follow sound agricultural engineering principles may unduly lower the water table of adjoining sandy land or expose muck soils to a high rate of oxidation (Mellinger, 1989).

Irregularity of rainfall, the sandy character of the soils, the high value of some farm products, and the increase in intensity of farming have led to an increasing use of irrigation on agricultural lands in Florida. According to the United States Census of Agriculture Report in 1990, 1,910,505 acres of land on Florida farms were irrigated in 1990. Agriculture used 3,806,000,000 gallons of water per day throughout the state during the same year. However, there are no records of how much water is used by the Florida cattle ranchers.

Most irrigation systems are single farm installations that draw water from wells, lakes, springs and streams. Groves are mainly irrigated by portable perforated pipe sprinklers, fixed or moveable overhead nozzle-sprinklers, or by portable pipes. Flood irrigation from ditch or trench is more common on

vegetable lands, although sprinkler and other systems are also used (Haan, 1977).

The largest acreages of irrigated cropland are located in central and southern Florida counties. There were very few counties with sizable acreage of irrigated pastures during the time of this research project. The 246,000 acres of irrigated agricultural land were found in Osceola, St. Lucie, Martin, Palm Beach, Highlands, Glades, Collier, and Hendry counties (Table 3.2).

Parasites, weeds, insects, nematodes, and diseases affect the character of agriculture through their negative effects on yields and costs. Insects, if not controlled, may destroy a feed crop or reduce yields below an acceptable profit level during some seasons. The cost of controlling insects, parasites, or diseases may discourage the production of a particular crop or class of livestock. The development of new strains or varieties of feed crops with higher yields or greater disease resistance may result in an increase in acreage of this crop in new areas or retention in previous areas (Baker and Cook, 1982).

Population and Markets

Florida's rapid population growth has also contributed to an increased competition for land and water resources. The 1995 estimate was 13,846,500, an increase of 908,600 people over the Census count of 1990 or a 6.56 percent increase in five years (Table 3.3).

Florida's population of Florida is unevenly distributed over the state. Five of the 67 Florida counties --Broward, Dade, Palm Beach, Pinellas, and Hillsborough-- contained over 50 percent of the state's population according to the 1990 Census. In a regional breakdown, 37 percent of the population was in 10 the counties of south Florida, 18 percent in 21 counties of northeast Florida, and 10 percent in the 16 counties of northwest Florida. While the location of the milk and egg production is highly dependent on urban population conglomentations the production areas for citrus, livestock and vegetables are affected more by physical factors.

Florida enjoys good transportation facilities. Federal and state highways extend to all sections of the state. Most farms are located on or near all-weather roads.

Table 3.2 Water use for Agricultural Purposes
(Source: US Department of Interior, 1990).

Product	Acres	Total	Ground	Surface
Total	**1,910,505**	**2,978.5**	**1,646.31**	**1,332.20**
Vegetable crops	342,750	496.35	396.43	99.92
Carrots	20,200	18.42	7.34	11.08
Cucumbers	24,548	46.89	46.86	0.03
Peppers	23,092	39.62	39.51	0.11
Potatoes	27,441	37.97	37.97	0.00
Tomatoes	58,154	135.57	132.58	2.99
Sweet corn	65,360	74.32	26.35	47.97
Other Veg.	113,120	122.00	84.28	37.72
Fruit crops	693,317	1,142.20	650.72	491.48
Citrus	610,720	1,009.6	523.68	485.91
Watermelons	47,125	51.44	47.15	4.29
Other fruit	25,340	58.61	58.25	0.36
Field crops	485,597	610.31	72.60	537.71
Field corn	42,629	52.39	34.56	17.83
Peanuts	18,586	11.80	8.90	2.90
Soybeans	9,835	7.36	6.01	1.35
Sugar cane	379,250	505.41	0.00	505.41
Tobacco	6,674	7.03	6.89	0.14
Wheat	10,533	5.03	3.51	1.52
Ornamentals	388,841	663.26	468.29	194.97
Ferns	6,682	32.29	27.46	4.83
Flowers	11,124	58.63	47.07	11.56
Woody ornam.	17,918	99.56	81.22	18.34
Improved Pas.	246,438	222.57	163.62	58.95
Sod & Turf	279,080	250.21	148.92	101.29

Railroad service includes three important rail lines - the Seaboard Coastline, the Florida East Coast Railway, and the Southern Railway. Jacksonville is the major rail gateway for the state of Florida. Good rail facilities connect Florida with the North and West but in many areas of the state the short local lines have been abandoned. Florida is also served by several ports, Tampa, Jacksonville, Port Everglades, Palm Beach, Miami, and Pensacola. These sea ports handle most of the sea going traffic.

When examining the location of the cow/calf industry in Florida, an approach would be to consider the origins of the raw materials, fertilizers, mechanical devices, etc.) that this cattle industry needed and the destination of the feeder calves, using the transportation system as the key to analyze ranch location (Figure 3.3). Taking the annual average of cash receipts in 1987 as a base period equal to 100 index points, the production index rose from 109.6 in 1988 to 116.9 in 1989 (Dunkle, 1994). During the same time, the annual index of cash receipts for livestock production fell from 98.2 in 1987 to 96.8 in 1988 and rose to 97.1 in 1989.

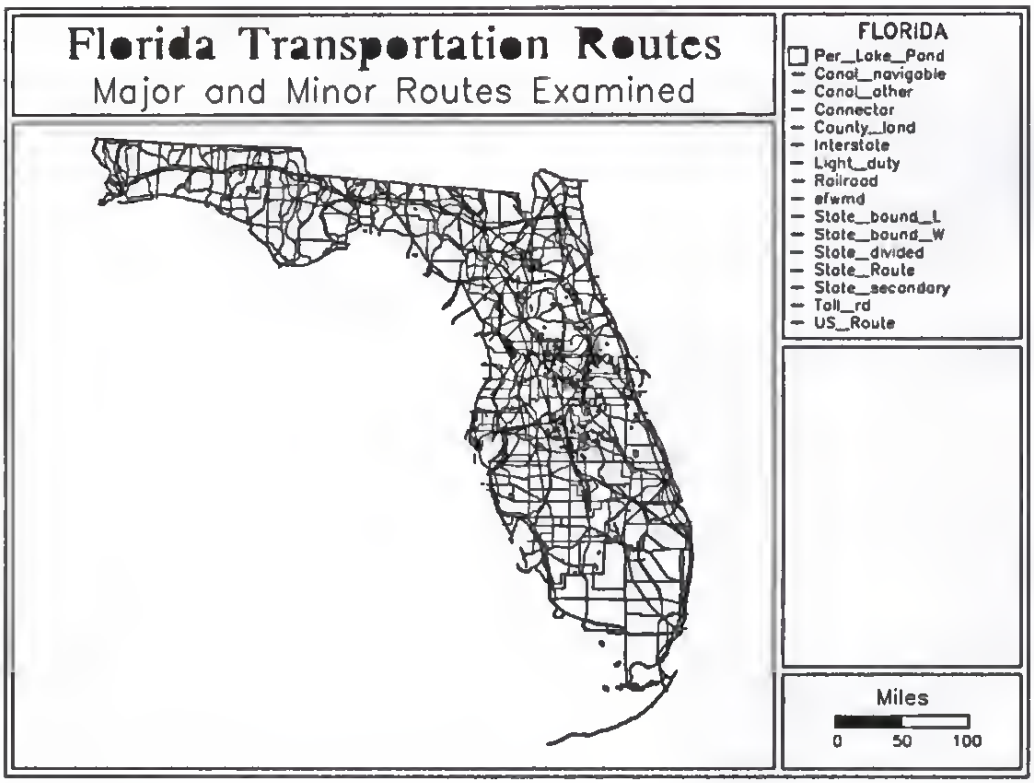

Figure 3.3 Florida transportation routes. Source: Florida Division of Transportation Planning, 1990.

Table 3.3 Population of Florida: urban versus rural populations.

Years	Total	Urban	Rural	Percent Rural
1830 (June 1)	34,730	0	34,730	100.0
1840 (June 1)	54,477	0	54,477	100.0
1850 (June 1)	87,445	0	87,445	100.0
1860 (June 1)	140,424	5,708	134,716	95.9
1870 (June 1)	187,748	15,275	172,473	91.9
1880 (June 1)	269,493	26,947	242,546	90.0
1890 (June 1)	391,422	77,358	314,064	80.2
1900 (June 1)	528,542	107,031	421,511	79.7
1910 (April 15)	752,619	219,080	533,539	70.9
1920 (January 1)	968,470	353,515	614,955	63.5
1930 (April 1)	1,468,211	759,778	708,433	48.3
1940 (April 1)	1,897,414	1,045,791	851,623	44.9
1950 (April 1)	2,771,305	1,566,788	1,204,517	43.5
1960 (April 1)	4,951,560	3,077,989	1,873,571	37.8
1970 (April 1)	6,791,418	5,544,551	1,244,892	18.3
1980 (April 1)	9,746,324	8,212,385	1,533,939	15.7

(United States Bureau of Census, 1990)

The volume of agricultural products shipped out of the state by water is not large, but many agricultural supplies are shipped into the state by this means. Agricultural production in Florida has grown rapidly during the last eight years (Table 3.4).

Table 3.4 Cash Receipts of Farm Income

Activity	1987	1988	1989
Crops	$4,207,000	$4,688,000	$4,982,000
Cattle	$388,000	$372,000	$377,000

(United States Department of Agriculture, 1990)

Land Tenure Patterns

Between 1920 and 1965, agriculture in the state exhibited two conflicting trends. From 1935 to 1964, there was a reduction of 44 percent in the number of farms, but acres of land in farms increased 2.5 times. Average farm sizes increased from 83 acres to 380 acres. The average value of land and buildings was $4,407 in 1935 and $109,732 in 1964 (Florida Statistical Abstract, 1987, 1991 and 1995). In 1982 the average farm size was 353 acres and in 1987 it was down to 306 acres. The average value of land and buildings was $552,586 in 1982 and $543,830 in 1987 (Florida Statistical Abstract, 1987).

As the number of farms dropped there was a definite shift in the tenure pattern. The number of tenants decreased from 28 percent in 1935 to 6 percent in 1964 (Florida Statistical Abstract, 1967). The importance of full owners increased although there was a decrease in the absolute number

of owners. The decrease in tenants in the state was associated with the decline in acres in cotton and the increase in acres in citrus and specialized truck crops.

Land Uses in Florida

According to the Census, the acreage designated as "land in farms" consists of agricultural lands, land used for crops and pasture or grazing, and considerable areas of land not actually under cultivation or used for pasture or grazing. Woodland and wasteland owned or rented by farm operators is included in land in farms unless it is being held for a non-agricultural purpose.

Only 44 percent of Florida's land area of 34,721,280 acres was in farms in 1964, but 70.3 percent of Florida's acreage was in farms by 1988. In 14 of the state's 67 counties, less than 15 percent of the total land area was in farms, 19 counties had 20 to 39.9 percent, 16 counties 40 to 59.9 percent, and 18 counties 60 percent or more (Florida Statistical Abstract, 1990). About one half the counties with less than 40 percent of the land area in farms was located in northeast Florida and one fifth in south Florida. Counties with the highest percentage of the total land area in farms were located in central and southern Florida (Table 3.5).

Table 3.5 Florida Agricultural Land Use.

Land Use	Percent of Total	Acres
Cropland	36	3,875,787.72
Other Land	5	538,303.85
Pasture and Range	41	4,414,091.56
Woodland	18	1,937,893.86
Total	100	10,766,076.99

(United States Bureau of Census, 1990)

Land not in farms is the difference between the total area of a given county in Florida and acres in farms. Thirty-one percent of the land not in farms was swamp land and other poorly drained land. Most of this land use lies in the Everglades National Park Area.

Cropland is the sum of harvested cropland, cropland used only for pasture, and cropland not harvested and not pastured. Florida had 6,875,105 acres of cropland in 1910. This was 20 percent of the total land area in the state (US Agricultural Census, 1980). Considerable variation of farmland under crops existed from one county to another because of physical features. The proportion of farmland under crops varied from 2 percent in Franklin County to 92 percent in Dade County. Palm Beach and Dade counties on the Gold coast had the highest percentage of farmland in crops. Counties where citrus is grown had a fairly high percentage of farmland in crops and

were located in north and west Florida (Weischet and Caviedes, 1987). Land in farms amounted to 10,766,077 acres in 1992. In 1987 land in farms totaled 11,194,090 acres.

Pastured woodland includes all woodlands used for grazing. Woodland not pastured refers to all woodland not used for pasture or grazing, including land placed in the soil bank and planted in trees.

In 1990, land in farms included 12,869,518 acres in woodland, of which 57 percent was pastured woodland and 61 percent woodland that was not pastured. Pastured woodland accounted for 32 percent of the total land in farms in 1967; in 1990 it had, increased by 25 percent. Pastured woodland is widely distributed over the state. The counties with the highest percentage of land in farms have the lowest percentage of land in pastured woodland.

Woodland not pastured accounted for less than 10 percent of the total land in farms in half the counties. Woodland not pastured is distributed differently. The counties in which woodland not pastured was a sizable percentage of all land in farms were mainly in north and west Florida.

Improved pasture refers to all land other than woodland and crop land that was used only for pasture or grazing. It includes non-crop, open or brush pasture, and cut over or deforested land that has been improved and is used for

pasture. Of the land in farms, 5,386,176 acres were classified as other pasture (not crop land or woodland) in 1992 (Florida Statistical Abstract, 1991). This was 28 percent of the land in farms. Counties with the highest percentage of farm land in other pasture were those north and west of Lake Okeechobee. The area of other pasture in counties of North and West Florida was less than 18 percent of the total land area in farms.

"Other land" refers to all land not included in the preceding land use classifications, such as house lots, lanes, roads, ditches, land area of ponds, and wasteland. Other land amounted to 1,008,269 acres or 7.5 percent of the total land in farms in 1980 (Florida Statistical Abstract, 1991).

The 1980 United States Census of Agriculture recognized eight major types of farming in Florida, (1) cash grain, (2) other field crops, (3) vegetable, (4) fruit and nut, (5) poultry, (6) dairy, (7) other livestock, and (8) horticultural. This classification is based on the source of cash income from farming in 1980. For a farm to be classified as a given type, it was necessary that it derives 50 percent or more of the value of farm products sold from the source indicated in the description. For example, a farm was classified as a vegetable farm if 50 percent or more of the cash income from the sale of farm products was derived from

tomatoes (United States Census of Agriculture, 1980). Part-time, residential, and very small farms were not classified by type. They were called miscellaneous or unclassified farms.

The largest number of commercial farms were classified as fruit and nut operation. This was followed by other livestock, and vegetable (Table 3.6). Slightly over half the farms in the state were unclassified (personal interview University of Florida Extension agent, 1993). The location of farms of specific types or combination of types gives rise to certain types of farming areas.

Lands without direct agricultural use is land in forests, marshes, and cut-over lands, and often is not included as a part of the land in farms in this study. Further, commercial farming occupies only a small part of many counties. For these reasons, distinct types of farming do not stand out in Florida as elsewhere in the United States.

Urban Expansion and Shrinking of Crop/Pasture Lands

Most major expansions of land use for crops or urbanization in Florida have a pronounced impact on acreage in pasture. In some parts of the state, large portions of current pasture land could probably be converted into crop

land or into residential land as often occurs in the southeastern region of the state (West Miami,

Table 3.6 Acreage and crops in 1990.

Crop	Acres Under Selected Crop	Percent of All Land Under Crops
Corn for Grain	89,000	1.30
Hay-All Types	690,000	10.04
Land in Orchards	1,935,000	28.15
Peanuts	77,000	1.12
Sugar Cane for Sugar	1,432,000	20.84
Vegetables	2,650,000	38.56
Total	6,873,000	100.00

(Source: Florida Statistical Abstract, 1991)

and Ft. Lauderdale for example). The unremitting increase in urban and built-up land, especially in southern Florida, compound this impact because urbanized land would come directly from pasture and from crop land, in which case pasture would tend to be converted to cropland to replace lost cropland (Asher, 1978). Although deprived of much of its land base, the Florida cattle industry might survive, partly on the basis of intensive fertilized pasture, partly on rough lands not suitable for crops, and partly through increased grazing of forest land.

Areas of Florida experiencing rapid population expansion continue to face the prospect of declining environmental quality and economic utility derived from the natural resource base. Paradoxically, in our increasingly insouciant, service-based economy, the quality and quantity of environmental goods are the principal factors causing population growth. Approximately 1.5 million acres of land were converted into urban uses in Florida from the mid-1970s to the mid-1980s (Florida Statistical Abstract, 1987, 1990). During that time, the population increased by more than three million people. The amount of land converted to urban uses varied from .347 acres per person in MSA counties in the Central and South to 2.026 acres per person in the non-MSA counties in the North (Figure 3.4). Urban growth in Florida results in higher rates of conversion of land to urban uses than in other areas of the United States.

Florida's intense rate of population growth may have serious implications for the quality of life in some areas of the state. As the so-called "bi-coastal economy" develops the coastal areas of the state are among the most heavily affected (i.e., Dade and Sarasota counties), but similar impacts are being felt in certain areas of the "sun belt" and in many other areas having superior environmental attributes (Colorado mountain areas, etc.). One particularly

important impact on the natural resource base is the conversion of formerly in extensively used land, (agriculture, forestry, and wetlands) into urban uses. These changes are perceived as resulting in a dwindling of aesthetic and ecological values.

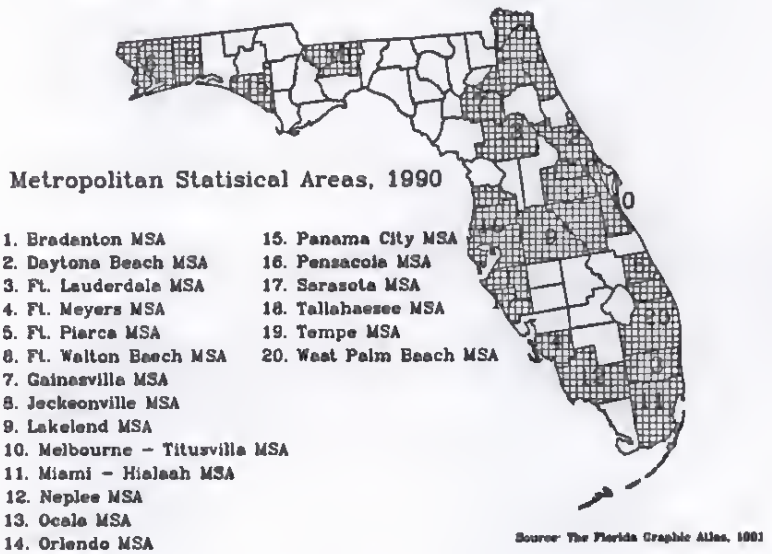

Figure 3.4 Metropolitan Statistical Areas.

In today's market economy the emphasis is on private property rights and generally flexible land use controls. As a result, the amount of land converted from extensive uses to urban uses in different areas increases directly with population growth. Florida's comprehensive Growth Management Act of 1985 addresses the issue of more environmentally responsible growth. It promotes the concept of an ideal

urban form, which may be described briefly as a more compact development pattern with less urban sprawl (Audirac, 1989). It is assumed that this compact urban growth pattern will result in fewer acres of farmland, wetland, and other extensively used land being transformed into urban uses.

Land Conversion

There is a high rate of conversion of land from rural to urban and from natural lands to pasture use in Florida. Only about 2 to 3 percent of the total land area of the United States is accounted for by urban development, and only a minute fraction of a percent are converted to urban uses each year (Frey 1986). However, the amount of land in urban areas in Florida is expanding more rapidly. Urban land is a relatively small part of the total land area, less than 10 percent, but still high compared to many states. Land in urban areas in Florida increased from 513,000 acres in 1945 to 2,867,000 acres in 1982.

The environmental impact of land use changes is also important. Competition between mining, forestry, various agricultural uses and wetland uses often involves larger acreage and, occasionally, has potential for environmental impact as the conversion of land uses takes place. In fact, the changes of these natural land uses to urban land uses

are related to, and perhaps driven by, urban population growth. It is clear that the hypothesis of the conversion of wetland to farmland is often an intermediate step in the process of urbanization, and that such a step is encouraged by regulation and institutional control.

Cropland acreage in Florida increased by 1.3 million acres from 1945 to 1982 (Florida Agricultural Census, 1945). Land in pasture and range grew by about 2.2 million acres, while land in special uses rose by 4.8 million acres during the same period. Special uses include urban use, parks, wildlife refuges, roads, highways, airports, and defense areas. Increases in land devoted to these uses was made at the expense of forest land and "other" uses.

Special use areas include areas such as marshes, swamps, and bare rock. For Florida, most of the land listed in public data resources as "other land" is likely to be wetlands. In general, as the demand for agricultural land, urban, and other land uses increase land is converted from extensive uses to more intensive uses. Development has moved further south in the state as well. Additional land has been converted to cropland and pasture and these agricultural lands are more vulnerable to urban conversion than wetlands in the same areas. Population in Florida has doubled every 20 years, increasing from about one million people in 1920

to about 13 million in 1990 (Bureau of Economic and Business Research, 1989). With such population growth, large extensions of land are needed for homes, schools, shopping centers, transportation networks, and commercial and industrial uses. As the demand for high value uses increases, land is bid away from more extensive uses, such as cropland, pasture, land and other "undeveloped uses". Those who wish to develop land for urban uses generally find it relatively easy to bid land away from extensive uses because of the higher capitalized net returns (economic rent) in the more intensive urban uses.

Florida Grazing Lands

Clearly, pasture is an important category of land use in Florida. Land used exclusively or primarily for grazing (pasture and rangeland) amounted to 4,871,727 acres in 1987 and 4,551,334 acres in 1990 (Florida Statistical Abstract, 1987). This is 14 percent of the state's total land base in 1987, and 13 percent in 1990. There is also a large but difficult to measure area of forest land that is grazed, often on a somewhat casual basis.

Most grazing in Florida is by the beef cow/calf industry. Smaller grazing demands are made by milk cows and sheep throughout the state. The bulk of the state's grazing

land is in the southern reaches of the state on range land that has never been cultivated for other crops.

Land use in Florida has changed over time, with particularly dramatic shifts occurring since the early 1940s. The most recent directions of land use change are those that have been taking place since 1980. Cropland has experienced a pronounced net increase, much of it due to increases in the cultivation of ornamentals and truck crops. Forest land and grazing land have decreased, while developed land and land set aside for wild life and rural parks have grown. The residual category "other lands", has tended to decrease in recent years, as lands previously so classified have been drained or cleared for agricultural use, urbanized, or set aside as parks or wildlife reserves.

The Place of Cattle Ranching in Florida

The need for a comprehensive understanding of agricultural production systems in general, and livestock production systems specifically, has been realized in Florida where agriculture has been characterized by diversity and continuous growth. There is also a need to explore the social structure that affects the motivations, methods of production, and goals of cattle ranchers in Florida through understanding

the history and geographic distribution of cattle ranching throughout the state.

Florida Cattle Ranching Development

The second highest cattle to people ratios in the South during the 1860s were found in Florida. By 1860, the three Florida counties of Manatee, Brevard, and Hillsborough had cattle to people ratios of 37 to one, 31 to one and 13 to one, respectively (United States Bureau of Census, 1860). With such high number of cattle, south Florida was the site of commercial cattle ranching, focused on Cuban markets.

There are few records describing the sandy pinewood forest cover that dominated the Florida landscape. These barren lands supported little more than strewn pine trees, dwarf palmettos and wiregrass (Gilliard, 1855). Though pinewood land was worthless by agricultural standards of the time, it was unsurpassed as grazing country. Thanks to the mild winters, grass grew well and cattle were well supplied with feed at all seasons of the year. As a result, the majority of the population in the southern portion of the Florida peninsula was cattle ranchers, grazing their stock on the expanses of pinewood ranges.

South Florida's promising cattle trade with Cuba rested on the shoulders of the Florida "scrub" steer. The scrub steer

traced its ancestry to the Iberian cattle, which were introduced by the Spanish colonialists who settled Florida before 1820, and mixed with the British stock bought in by southern ranchers from the Southeastern States who settled in Florida after 1821. Left to fend for themselves in the Florida pinewood, scrub cattle evolved into hardy animals, which survived on native grasses, endured the extreme heat, and developed an immunity to endemic stock diseases. Though small and lean the scrub steer was hardy. A mature animal weighed only 500 pounds, yielding perhaps 250 pounds of beef (Rouse, 1977). Tough by modern standards, scrub beef had a flavor resembling that of venison, Florida steers proved popular in Cuba (Kennedy, 1942).

After the Civil War, the open range cattle industry dominated south Florida's economy. The focus of the cattle trade at that time shifted from Tampa to Punta Gorda in southwest Florida. Between 1870 and 1880, south Florida exported over 165,000 beef cattle, which were valued at more than $2,400,000 (Mealor, 1972).

Cuba served as the major market for Florida beef until the early twentieth century, when Venezuelan beef supplanted Florida steers in the Havana stockyards. Losing their Cuban trade, Florida cattle ranchers turned to the North American market. Finding little demand for their small steers outside

Florida, ranchers began the long and costly process of improving their beef cattle. They eliminated endemic stock diseases, bought registered bulls, purchased grazing lands, erected fences, planted artificial pastures, and produced larger and better quality steers that permitted them to capture a significant share of the American beef market (Mealor, 1972).

Despite the growth of the improved cattle industry, traditional cattle ranching survived well into the 1940s. In the years after World War II, open range cattle ranching gave way to commercial farming and urban development in much of south Florida. Truck farmers and citrus growers acquired great tracts of pinewood range land for their fields and orchards. In turn, urban areas impinged on the open range, as thousands of retired Northerners settled in housing developments and trailer parks.

Open range cattle ranching was simply not compatible with agribusiness and urban life, as they trampled vegetable fields and invaded citrus groves, strayed onto public highways and streets, and even collided with cars and trucks (Mealor, 1972). Complaints about traffic accidents and stray cattle prompted the Florida legislature to pass a law in 1949, requiring all stock owners to fence in their cattle. Owners, who negligently allowed their stock to wander onto public

highways and streets could be fined or imprisoned. This law effectively ended over a century of open range cattle herding in the State of Florida (Florida Cattleman and Livestock Journal, 1949)

Effects of Agricultural Development and Technological Change

Fertilizers and pesticides currently account for a greater share of input costs for most major crops than they did in 1965. This is primarily the result of high yield fertilizer applications and continuous cropping, which has created favorable pest habitats in certain crops. The national average cost of fertilizers and pesticides for corn production in 1986 was about 55 percent of variable costs and 34 percent of total costs (Bureau of Economic and Business Research, 1989). For soybeans, the figures were 49 and 25 percent and for wheat, 40 and 23 percent. By increasing use of these costly agricultural input items, farming has become dependent on industry. Today, an agricultural enterprise will use resources that optimized production in order to in optimize profit.

However, the Florida livestock industry does not require the same inputs as general farming. The average Florida cattle rancher is not investing in a series of costly agricultural

inputs. Nonetheless, cattle production in 1992 was 54 percent above the total level of production of the 1950 agricultural census period. In 1950 Florida produced 1,054,899 head of cattle, and in 1992, 1,940,000 head of cattle (Florida Agricultural Census, 1992). Interestingly, Dade, Palm Beach, Hamilton, Liberty and Putnam counties lost between 3 and 11 percent of their cattle production during the same forty-year period.

Increases of 95 to 99 percent in beef production were experienced in Hardee, Manatee, Hendry, and Glades counties, illustrating a shift in the location of cattle ranching in Florida. The shift is toward the southern counties, but away from the areas of intense urbanization in the southeast of the state. The average rate of increase over the same period was 6.3 percent per year for all crops and 1.08 percent per year for livestock. Agriculture brings over $6 billion per year to Florida's economy in total sales and accounts for one in five jobs in the state. Cattle production is a very important part of Florida agriculture.

Permanent pastures and other forages such as hay or seasonal pastures remain the largest single use of land in Florida. About 11,194,090 acres were occupied by these forage crops at the time of the 1987 agricultural census (Florida Statistical Abstract, 1991). The kind and combination of

approaches used by farmers in any specific area result from the interaction of many factors. The most important of these factors are soils, topography, climate, market prices, labor cost, availability and transportation facilities, and just the farmer's personal judgment. Some of them, such as soils, and climate, place definite limitations on agricultural activities. Introduction of new techniques and changes in economic factors, such as price relationships, have caused great changes in the agriculture of an area in a relatively short period. An example of this phenomenon is the southward migration of the citrus industry due to the increase of devastating freezes in the northern reaches of Florida (Miller, 1992). Other factors that affect the farmer's decision-making process are land use regulations, land use limitations, resource scarcity, and competition for water and land.

The mismanagement of inputs, through ignorance or shortsightedness, carries an expensive environmental cost. Every human civilization appears to have experienced one or more of the following problems: water-logged soil, increased salt concentration in drinking water, soil erosion, contaminated aquifers, shrinking lakes, and degraded aquatic habitats. The question to be answered here is: where in the state are these problems developing into potential hazards? When these problems become extreme, the agricultural

foundation of a society may be destroyed. Anthropologists, agriculturists, economic ecologists and historians believe that the failure of large scale agricultural systems have caused the collapse of several ancient civilizations (Pointing, 1991). Maintaining a viable agricultural industry in the state is important for the state's economic health and expected development. Agriculture must do its part to protect Florida's delicate natural ecosystem and to maintain the state's natural resources.

CHAPTER 4

METHODS

This chapter describes the methods and approaches used to prove the hypothesis that cattle ranchers use production practices that are environmentally protective. The ranchers' ability to adopt "current" environmentally protective agricultural technology will also be examined. Several methods are used to evaluate the degree to which cattle ranches in Florida are using environmentally protective agricultural practices, including improved water, as well as nutrient and pest management. The chapter is organized as follows:

1. Population description and sample selection;
2. The survey instrument;
3. Data collection;
4. Statistical analysis.

Population and Sample Selection

Personal interviews were conducted with beef producers in ten Florida counties in the period February to August 1993. Two counties in each of Florida's five Extension

Districts were selected for data collection. The selected counties (10 in total) had the highest acreage in pasture in each Extension District (Figure 4.1).

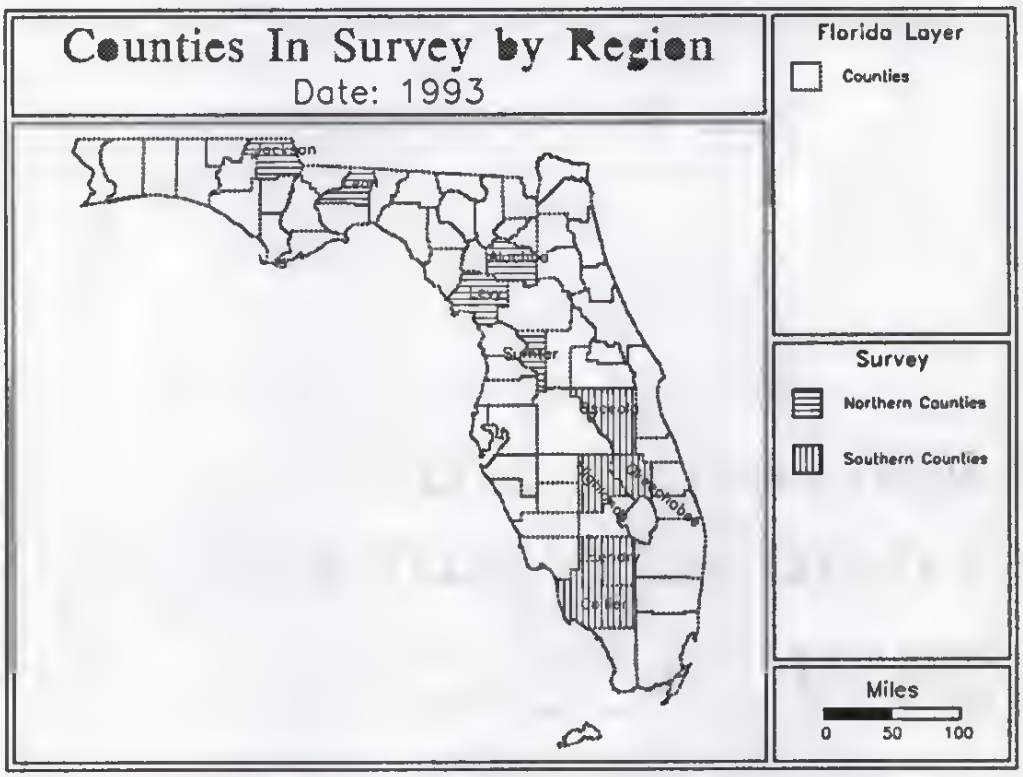

Figure 4.1 Counties selected for the 1993 cow/calf survey by region.

County Extension mailing lists obtained from the extension agents' personal contacts with the ranchers were used as the basis for selecting the sample of cow/calf producers. These lists, while not all inclusive, are a better source than the Florida Cattlemen's Association membership list inasmuch as there may exist some

relationship between such factors as farm size or operator characteristics that correlate to membership within the Florida Cattlemen's Association. A total of 1,036 beef producers were included in these lists. Our sample was restricted to beef producers with 50 or more head of cattle.

Survey Instrument

The survey instrument used to gather the data in this study was administered through face-to-face interviews with the cattle ranchers at their business or place of residence. The survey instrument was designed with the help of Dr. K. M. Portier of the University of Florida Statistics Department The survey was expected to be conducted by personal interview, and because of this fact allowances were made for about a 5 percent rejection rate. Scalar questions primarily elicit responses on a four-point scale. The questions in the instrument reflect the production practices that are appropriate for the cattle industry and consisted of 84 closed form questions. Originally, the questionaire was formulated as part of a state wide survey to determine the sustainability of several segments of Florida agriculture.

The questionnaire was examined for content and relevance by members of the Animal Science Department, County Extension Directors from several counties, cattle ranchers, and Dr. Marilyn Swisher, the lead research person. Participants

involved in the preliminary survey instrument test provided information that helped to shape the final questionaire, but their responses were not included in the data analyzed (Appendix A). The survey instrument was divided into three main subject areas. The first section deals primarily with demographic profiles and general information about the cattle ranchers, and is further divided into two subsections:

1.1 operation characteristics, annual production, acreage devoted to cattle production; and

1.2 demographic information about the cattle rancher; age, sex, educational level, experience in the cattle business, and sources of information.

The second section addresses management practices and changes in cattle ranching practices since 1983. The questions included are grouped in six subsections addressing:

2.1 major soil type and pasture type (improved or unimproved) and the amount of each type of pasture;.

2.2 water management concerns: whether or not the rancher is using irrigation to water livestock or irrigate their pasture, source of drinking water (well or standing), monitoring of water use (yes or no);

2.3 nutrient management: use of soil testing to determine fertilizer application rate, factors that determine when and how much fertilizer is used, and use of legumes;

2.4 pest management: factors influencing management decisions, how pesticides are applied (if any), how and what protective gear is employed for employee protection;

2.5 crop land use if any; previous land use, and, if possible, the intensity of land use;

2.6 renovation practices;

The third section reflects the opinions of the cattle rancher regarding these issues:

3.1 the importance of government regulations, and

3.2 factors that affect the profitability of the ranch such as taxes, regulations, record keeping, and animal welfare issues.

Survey Application

All producers participated directly in personal interviews with the author to reduce experimental errors that result from multiple interviewers. All interviews with the cattle producers took place within a six-month period to reduce biases due to uncertain regulating processes, taxing

schedules, changes in environmental conservation and/or preservation efforts, or other factors that can vary with time. In addition, it should be pointed out that the types of questions asked are not time sensitive, like those of many public opinion polls. That is, producers are unlikely to change production practices in a short period of time and personal characteristics are also not likely to change rapidly. The interview process took place at the cattle ranch, in the residence or the office, with the owner or person in charge. While individual surveys are time consuming but thorough, this method provided a ninety-nine percent survey response rate.

Population Distribution

Like agriculture in the United States as a whole, Florida agriculture is highly stratified by region. For example, the 4.2 percent of largest ranches in the state (owning over 500,000 head each) account for approximately 46 percent of all cattle that are raised in Florida. Because production is concentrated on larger scale units located in the southern part of the state, independent samples for different regions were drawn (Swisher, 1993). The selection of independent samples by region permitted analyses both, within and between different regions. These analyses reveal

the relationships, if any, between location (region) and associated socioeconomic characteristics of the ranch and sustainable agricultural potential (Swisher, 1993).

Determination of the Sample Size

There are approximately 1,500 cattle ranchers in the state of Florida. The size of the sample selected for this study is important because taking a larger sample than is required to achieve the desired results is inefficient and costly. On the other hand if samples are too small the results may be of no practical use. In order to determine the sample size required for estimating the population mean of Florida cow/calf producers. This study uses the confidence interval as determined by $\pm Z\sigma$. Increasing the magnitude of Z produces a wider confidence interval. In this study, $Z = 1.96\sigma_{\bar{X}}$ and the confidence interval is 95 percent. The entire area under the normal distribution curve of $\bar{X}$ beyond the confidence limits (α) are $\mu \pm 1.96\sigma_{\bar{X}}$, thus the area within the confidence limits are $1 - \alpha$.

The size of the sample is determined by the size of σ (standard deviation), the desired degree of precision (E), and the desired interval width. This study uses a sample that is capable of yielding a point estimate of μ where E (precision

level) is 0.10. The confidence interval is 95 percent, and there is a 5 percent chance of drawing a sample size (n) with an estimate for μ that is more than 0.10 units off the acceptable (Cochrane, 1963). The standard deviation of the study population of 1,500 Florida cattle ranchers is 0.4179. The desired precision is $E = 0.10$ or 90 percent, and a confidence level for the study is set at $\alpha = 0.05$, or 95 percent. The formula used in this study is

$$n = (Z_{\alpha/2}\ \sigma/E)^2$$

$$n = [1.96(0.4179)/0.10]^2$$

$$n = 67.08989 \approx 67$$

The resulting sample size was determined to be 127 beef and/or livestock producers. There was some difficulty in gathering data from the ranches of the southern region and it was necessary to replace 52 percent of the ranchers selected to compensate for those who had gone out of business within the last year, for those who were reluctant to give information, and for incorrect addresses. The final sample size of 67 was within the accuracy range. The expected error rate for a sample of this size is ± 0.10 with 95 percent confidence interval.

Data Collection and Processing

Following the determination of the sample size and sample selection, data collection was conducted. This process involved three steps:

(1) A form letter was sent to each cattle rancher by the County Extension Director of the Florida Cooperative Extention Service, explaining the purpose of the study and urging the participation in the survey.

(2) Appointments were scheduled by the author with the help of the County Extension Office.

(3) Following the confirmation of several appointments in a given county, the surveyor traveled to the appointment place and conducted the surveys.

There were no distinguishing traits on any of the surveys and each of them was differentiated only by county. In this manner, each survey remained anonymous and the geographic distribution of the data could be inferred. The list of participants was destroyed after the surveys were complete and the data deemed accurate.

Once data collection was completed, the data as entered in a computerized data base and, reviewed for errors in accuracy. The data were analyzed using SAS v6.04 (SAS Institute, 1988). Information concerning the demographic

characteristics of the Florida cow/calf ranchers (Objective 1) is illustrated by means and frequencies. Objective 2 is protrayed using the rate of change to ascertain the application of sustainable cattle ranching practices. Objective 3 is achieved by examining the perceptions of the cattle rancher and their views of government regulations, environmental and economic issues. Objective 4 is of geographic nature, concerned with the location of urbanization and cattle ranching operations, rates of change, and the intensity of cattle ranching as both of these land uses compete for land resources.

Regional Analysis

The data were analyzed by region: northern versus southern. This was done because these two regions differ in their herd sizes, ranch sizes, individual time spent on the ranch.

The distinction between a northern and a southern region differs significantly from the Kruskal - Wallis statistical model which tests the hypothesis:

> Ho: The medial scores for heard size data categorized in the two groups are equal. i.e., $M_1 = M_2$, with M_1 representing the average herd size in the northern

region and M_2 representing average herd size in the southern region (Ha: $M_1 \neq M_2$). The scores shown in Table 4.1 demonstrate the results of the Kruskal-Wallis test for differences and reveals clear regional differences.

Statistical Procedures Used

The Kruskal-Wallis test of differences between two population distributions was the statistical procedure used to assess differences between northern and southern ranchers. There was a measurable difference between the non-parametric results. Chi-square tests were performed to identify relationships among the survey variables.

Methodology to Examine the Changes in Agricultural Land Use

The extension of land converted to urban uses as related to population growth and agricultural activity was estimated and the differences in urban land conversion by geographic area were analyzed with the purpose of revealing the intensity of urban growth in Florida.

To estimate urban land used for urban purposes, the population data for areas experiencing urbanization are calculated using urban and non-urban land use coefficients.

These coefficients provide a measure of the amount of land converted to urban uses per person in MSA and non-MSA areas.

In the United States, about three-fourths of the population reside in Metropolitan Statistical Areas (U.S. Bureau of Census, 1990). A Metropolitan Statistical Area (MSA) is a geographic area containing a large population nucleus with adjacent communities that have a high degree of economic and social integration with that nucleus (Bureau of Economic and Business Research, 1989). Some MSAs comprise more than one county, but the counties have close economic and social ties to the major urban area.

In Florida, there are thirty-two counties that comprise twenty MSAs. Over 90 percent of the Florida population is located in counties that are part of MSAs. MSA counties represent 54.4 percent of the total land area of the state (Florida Statistical Abstract, 1991). More of the state's population is located in the central and southern part than in the northern part, although each region contains about 50 percent of the land area. Only about 22 percent of the state's population live in the north, and in 1984 population density in the north was about one-half of that in the central and south.

In northern Florida, 70 percent of the land area is in MSA counties. Over 60 percent of the population in the north

live in non-MSAs, while in southern Florida over 93 percent are found in MSA counties. The value of transition land (land changing to non-agricultural uses such as sites for homes and businesses) is much higher in Central and South Florida than in the north. At the end of the 1980s, the value of transition land within five miles of a major town averaged $3,600 per acre in the northwest and about $5,600 per acre in the northeast. In the central and southern region, transition land values within 5 miles of a major city averaged about $10,500 per acre in central Florida and about $36,700 per acre in southeast Florida (Florida Statistical Abstract, 1990).

Despite the widespread awareness of the changing nature of land use in the state of Florida, remarkably little has been published to illustrate the dramatic rate at which land use is changing in the state. The land use coefficient provides a relative measure of this change.

Table 4.1 Results of the Kruskal-Wallis test applied to the variable that addresses herd size.

Northern Counties

	Herd Size 1950	Test Rank	Herd Size 1990	Test Rank
Alachua	26,331	8	48,000	14
Leon	10,863	5	9,000	2
Sumter	12,616	6	55,000	16
Jackson	9,025	3	34,000	10
Levy	9,430	4	38,000	11
Totals		26		53

Southern Counties

	Herd Size 1950	Test Rank	Herd Size 1990	Test Rank
Hendry	4,727	1	11,7000	19
Okeechobee	42,589	12	16,8000	20
Collier	45,015	13	1,3000	7
Highlands	33,571	9	11,6000	18
Osceola	49,504	15	10,8000	17
Totals		50		80
n(n+1)/2	210			
T1+T2+T3...	210			
Ha	8.691			
Critical	7.815			
D.F.	3			
Reject Ho: $M_1=M_2$				

Rural Land to Urban Land Use Coefficients

Urban land use and rural land use coefficients show the extent of additional land converted to urban or rural land use for each person added to the population.

The urban land use coefficient (U_r) is calculated as

$$U_r = (U_2 - U_1)/(P_2 - P_1)$$

where

U_2 = the acres of urban land in 1980;
U_1 = the acres of urban land in 1990;
P_2 = the population in 1980; and
P_1 = the population in 1973.

The rural land use coefficient (R_r) is calculated as

$$R_r = (R_2 - R_1)/(P_2 - P_1)$$

where

R_2 = the acres of rural land in 1980;
R_1 = the acres of rural land in 1990;
P_2 = the population in 1980; and
P_1 = the population in 1973.

Data for urban and rural land use coefficients are presented in tables, and maps in the results of this dissertation (Chapter 5).

Methodology to Examine the Changes in Range Land Use

The methodology used to analyze pasture land conversion in a given geographic area (state or county) is based on coefficients that compare the state and county grazing land.

These coefficients provide a measure of the proportion of the state or county acreage converted to grazing land. Pasture land use and state or county area measurement coefficients are employed to represent the quantity of land converted to/or established in pasture for each acre removed from the state and county land base. The pasture land use coefficient for the state (P_s) is calculated as

$$P_s = (P_2 - P_1)/(S_1)$$

where

P_2 = the acres of county pasture land in 1990;
P_1 = the acres of county pasture land in 1987;
S_1 = the entire acreage of the state;

The pasture land use coefficient for the counties (P_c) is calculated as

$$P_c = (P_2 - P_1)/(C_1)$$

where

P_2 = the acres of county pasture land in 1990;
P_1 = the acres of county pasture land in 1987;
C_1 = the entire acreage of the county;

Herd-size Index

The herdsize index shows the fluctuation in the cattle population between the years 1987 and 1990. The herd-size index for a given county (H_1) is calculated as

$$H_1 = (H_1 - H_2)/ H_2$$

where

H_1 = the herdsize of counties in 1987;
H_2 = the herdsize of counties in 1990;

The Location Quotient

The location quotient is defined as a ratio of ratios. The resulting index (quotient) shows whether a larger or smaller amount of a given factor is present in a certain area. By using the location quotient the data for the counties is normalized and thus ready to be analyzed. The location quotient used in this study is as follows:

$$\frac{\text{county pasture acreage / acreage of all county land}}{\text{state pasture acreage / acreage of all state land}} = LQ$$

The location quotient expresses a ratio involving two proportions. This index (LQ) shows the extent to which each unit of a set of areal units departs from the overall proportion. In this dissertation the location quotient allows for the comparison of each county's share of pasture land with the aggregate total for the state. A location quotient of 1 means the acreage of pasture land in that county is of exactly the same relative size for pasture as is found across the counties of the entire state. A location quotient greater than 1 indicates an overrepresented acreage of pasture land. A location quotient less than 1 signifies

underrepresentation of acreage of pasture land. This procedure is used in this dissertation to compare different counties at different points in time: 1987 and 1990.

CHAPTER 5

RESULTS

The Florida cow/calf industry's use of environmentally protective practices and spatial distribution are the focal points of this dissertation. Cattle is raised in virtually all counties of Florida. Nevertheless, ranch and herd sizes vary geographically from county to county. Therefore, a stratified random sampling approach for this industry has been chosen to insure suitable representation of north and south Florida ranches.

Geographic Distribution of Samples

Two counties from each of Florida's five Extension Districts were selected for inclusion in the survey. These comprise the two counties in the district with the largest area in pasture according to the 1987 agricultural census. This stratified random sample is, once again, representative of the wide range of ecological and economic conditions

characteristic of the ranching activity in the state. North Florida counties surveyed include Leon, Jackson, Levy, Alachua and Sumter. South Florida counties include Hendry, Highlands, Okeechobee, Osceola and Collier. Independent samples were drawn for each county. Of the 127 completed questionnaires, there was a response rate of 99 percent, meaning that 126 surveys were answered correctly and entirely. The sample did not cover all counties in the state, and the results are not applicable to all ranches in Florida. However, the geographic distribution of the sample traversed the major physical regions of the state and the selected counties had high acreages in pasture indicating that they are representative of cow/calf production in Florida. There are significant differences between cattle production in north and south Florida (see Chapter 4 concerning Kruskal-Wallis testing) and there are several pasture types in Florida

1) Native pastures - The natural vegetation found on the unimproved pastures includes perennial grasses on the low sandy soils or flat pine lands, wire grasses, wild oats, and broom sedge.

2) Improved permanent pastures - These are pastures established through the destruction of some or all native vegetation by burning, rotary cutting, plowing, chopping and disking. Fertilizer is

applied and the land is seeded with carpet and dallis, pangola, napier, bahia, bermuda or heat tolerant St. Augustine grasses. In the winter legumes may be planted.

3) Temporary pastures - These pastures furnish feed only for short periods of time and must be established annually. Winter grazing pastures will usually contain rye rust resistant varieties of oats. Summer grazing crops will include cattail or pearl millet, starr millet, alyse clover, and hairy indigo (Cunha and Rhodes, 1966).

Farms in general are smaller in north Florida and cattle ranches are no exception. Use of unimproved pastures and native range is common in south Florida, whereas the northern rancher is more inclined to work with improved pasture. Therefore, the data is presented by northern and southern regions. Native, unimproved pastures include grasses, grasslike forbs, and shrubs that are edible by cattle and wildlife (Mullahey and Tanner, 1992). The stocking rate of a cow/calf producer is constrained by climate, forage value, soils, and rancher practices. These variables all differ regionally.

Significance Testing

The χ^2 test is widely used as a goodness-of-fit test (Burt and Barber, 1996). After the examination of the distribution of each variable in the survey, the next step is to investigate sets of relationships among two or more of these variables. This researcher chooses to use a contingency table form of analysis to test for variable independence. The test used in this dissertation is

$$\sum_{i}^{n=1} \frac{(fi - Fi)^2}{Fi} \equiv X^2$$

The χ^2 test is a test of statistical significance. It is designed to help determine whether a relationship exists between two variables. This is accomplished by computing the cell frequencies which could be expected if no relationship were present between the variables given the existing for row and column totals (marginals). The expected cell frequencies are then compared to the actual values found in the table according to the above formula where f_i equals the observed frequency in each cell, and F_i equals the expected frequency calculated as

$$F_i = \frac{c_i r_i}{N}$$

where c_i is the frequency in a respective column marginal, r_i is the frequency in a respective row marginal, and N stands for the total number of valid cases. The closer the set of F_i frequencies (expected frequencies) is to f_i (observed frequencies) the more likely the distribution of the sample reflects the probability distribution specified in the null hypothesis. The farther apart the observed and expected frequencies are, the less likely H_o is true. The test statistic is the sum of the relative squared differences.
The two cases tested are

H_o: The frequency distribution of the data reflects no statistical independence.

H_a: The frequency distribution reflects statistical independence, reject H_o.

The decision rule used in this dissertation is if $\chi^2 > \chi^2 (1-\alpha)$, conclude H_a.

Survey Results

The first section of the survey instrument concentrates on demographic information about the cattle ranchers. Northern ranches are more apt than southern ranches to have both cow-

calf and breeding stock (Table 5.1). In northern and western Florida, diversified farming is practiced. Through diversification, farmers are able to have several sources of farm income and do not depend on one item.

Table 5.1 Cattle operation type by region.

Region	Both Feed and Breed	Cow/Calf	Breeding Stock
Northern	0	82.6	17.4
Southern	4.6	88.4	7.0
$\chi^2 = 7.68$,	Pr = 0.021		

The northern ranchers' ability to diversify in cattle production while having both cow/calf and breeding stock operations allows him to sell both calves for fattening and keep breeding stock. In view of the demand for low fat, "healthy" beef products, some Florida ranchers consider expansion of cow/calf production while others are considering steer feeding (Personal interview with ranchers, 1993).

Herdsize of livestock ranching in the northern part of the state is small compared with the large herdsize characteristic of central and south Florida.

Herd Size

Only 66 percent of the south Florida sample had fewer than 100 head of cattle, whereas 78 percent of the north Florida herds had fewer than 100 head of cattle. The remainder of the north Florida sample, 22 percent, all represented herds of fewer than 2,500 animals.

Table 5.2 Herd size by region, 1983 and 1993.

Size Range	Northern Percentage 1983	Northern Percentage 1993	Southern Percentage 1983	Southern Percentage 1993
< 100	41.2	47.8	38.9	37.2
101-250	35.3	30.4	30.6	27.9
251-500	5.9	4.3	15.7	18.6
501-1000	11.8	8.7	8.3	9.3
1001-2500	0	8.7	0	0
2501-5000	5.9	0	0	2.3
> 5000	0	0	5.6	4.7
For 1983	$\chi^2 = 9.007$	Pr = 0.061		
For 1993	$\chi^2 = 3.101$	Pr = 0.054		

In south Florida, on the other hand, 27 percent of all herds counted between 251 and 2,500 head, and 7 percent of the sample were herds of more than 2,500 animals.

The ranches included in this survey comprised some 17,150 acres in North Florida and 164,547 acres in South Florida. Table 5.3 shows the distribution of ranches by size for each region. Ranch size was, as expected, smaller in north Florida, where 61 percent of all ranches had fewer than 500

acres total, nine percent had from 501 to 1000 acres, and only 4 percent had from 1,001 to 5,000 acres. There were fewer ranches in the smaller size category in South Florida. Only 34 percent of ranches had less than 500 total acres; 28 percent had from 501 to 1000 acres, and 20 percent had from 1001 to 5,000 acres in south Florida.

Table 5.3 Ranch acreage by region.

Category	Northern Region Percent in Each Category	Southern Region Percent in Each Category
< 500 Acres	61	34
501-1,000 Acres	9	28
1,001-2,500 Acres	22	20
2,501-5,000 Acres	4	7
5,001-10,000 Acres	4	6
>10,000 Acres	0	5
$\chi^2 = 23.744$	Pr = 0.001	

Some ranches, 7 percent, had over 2,500 acres. The differences in average in the two area's ranching is clearly illustrated in Table 5.4.

Table 5.4 The total ranch acreage in the southern and northern regions of Florida.

Region	Total Pasture Acreage
Northern	1,889.565
Southern	4,890.000

The total ranch acreage in the southern region of Florida is 2.58 times larger than in the northern region of the state. There is a tendency for the southern cattle ranchers to work these ranches full-time as a consequence of the size, costs involved, and a high demand for investment returns on their cattle operation. In the north, ranching is more intensive due to pasture types and higher stocking rates, however, because of the smaller herdsize, it is less likely to provide a living.

Demographic Profile of Ranchers

Demographic characteristics include the age of the cattle rancher, the highest grade completed in school, and years of experience in the cattle business.

Table 5.5 Rancher mean age and age range.

Age Range in Years	Percent in Each Age Range	Mean Age
	Northern	51
30-40	21.6	
41-50	34.5	
51-60	12.9	
61-70	21.6	
<71	8.7	
	Southern	57
30-40	9.1	
41-50	27.3	
51-60	20.5	
61-70	18.1	
<71	15.9	
Mean Age	State of Florida	54
χ^2=9.722	Pr=0.045	

The mean age of the north Florida sample was 51 years. In south Florida, the mean was 57 (Table 5.5). Cattle ranchers are slightly older in the southern region and need to pass their traditions and methods to the next generation at a faster rate than in the north.

A possible explanation for the presence of older ranchers in southern Florida could be found in the history of cattle ranching. Ranches located in southern Florida had ready access to the Cuban, Texan, and South American beef market during the 19th century accounting for the formation of a tradition of family involvement whereas those of the north were isolated from these markets and have developed only recently.

Table 5.6 Educational level by region.

Education Level	Northern Rancher Percent in Each Category	Southern Rancher Percent in Each Category
Less than High School	4.3	9.1
High School Diploma	52.2	38.6
Some College	30.4	27.3
Earn a College Degree	13.0	25.0
χ^2=7.12	Pr=0.052	

Compared with traditional livestock systems, environmentally protective farming systems usually require

augmented management skills and abilities along with greater reliance on proficient and knowledgeable labor. There is a pressing need for a greater knowledge base in the future to address the demands of an environmentally protective agriculture.

In the north, 52.2 percent of the surveyed ranchers completed high school, while in the south 38.6 percent had a high school diploma. However, while 43.4 percent of the northern ranchers surveyed had attended college, while 52.0 percent of the ranchers surveyed in the south had attended or graduated from college. Obviously, the southern rancher has more land, and seems to be more educated.

Table 5.7 Number of years in ranching.

Years of Experience	Northern Rancher Percent in Each Category	Southern Rancher Percent in Each Category
1-10	31.0	11.4
11-20	21.5	22.0
21-30	17.3	22.8
31-40	8.6	25.1
41-50	17.3	18.2
51-60	4.3	0.0
χ^2=22.221	Pr=0.001	

An environmentally protective approach is not one that simply rejects customary practices, but adopts innovative practices offered by the scientific and technological communities. In north Florida, 78.4 percent of the ranchers

surveyed had at least 40 years of experience. In south Florida, 81.3 percent of the sample had at least 40 years of experience. Thus, more southern ranches had been in the business 40 or more years.

Cattle ranching is a male dominated occupation. In both the southern and northern regions of the state most ranchers are men (78.3 percent in the north, and 84.1 percent in the south).

Table 5.8 Gender of ranch operator by region.

Gender	Northern Rancher Percent in Each Category	Southern Rancher Percent in Each Category
Male	78.3	84.1
Female	21.7	15.9
Total	100	100

A high percentage of all ranchers belonged to the Florida Cattlemen's Association.

Table 5.9 Trade association membership by region.

Membership in Trade Associations	Northern Percent Membership	Southern Percent Membership
Florida Cattleman's Association	72.2	83.3
Florida Farm Bureau	68.2	78.6
Breed Association	40.9	25.2
Other Sources	14.3	9.5
χ^2=5.708	Pr=0.127	

In north Florida, 72.2 percent of all ranchers in the sample subscribe to FCA and 40.9 percent belong to one or more breed associations. In south Florida, as many as, 83.3 percent belong to the FCA and 25.2 percent contribute to one or more breed associations. Because of the cost associated with membership, the southern rancher with his large herd size can afford membership and reap the benefits of the useful information offered by these organizations. Both northern and southern ranchers have confidence in advice from the University of Florida's Institute of Food and Agricultural Sciences. Over 50 percent of the state's ranchers rely on the scientific community's recommendations (Table 5.10).

The Florida peninsula has a rolling landscape that is characteristic of karst topography. Many soil types consist of quartz sands. These sands predominate where Florida's Central-Highland cattle ranches have been established. Table 5.11 shows that 31.8 percent of the surveyed ranchers in the north are located in the deep sand central region of the state. These sites of natural vegetation are dominated by eastern gram grass, switch grass, maidencane, and longleaf uniola (Mullahey and Tanner, 1992). The endangered plants and animals on these sites include adder's tongue fern, spleen wort, climbing dayflower, and culpet fern as well as

the Florida black bear and the Florida panther (Mullahey and Tanner, 1992).

Table 5.10 Sources of information available to Florida ranchers.

Level of Importance	UF or IFAS Employees Pr > t 0.008 Percentage		Consultant Pr > t 0.391 Percentage		Vendor Rep. Pr > t 0.148 Percentage	
	North	South	North	South	North	South
Very Important	18.2	25.6	4.5	12.2	9.1	12.2
Important	50.0	51.2	22.3	22.0	31.8	41.5
Not Very Important	9.1	15.3	22.7	24.4	35.4	34.1
Not At All Important	22.7	7.0	45.5	41.5	22.7	12.2

Other significant ranching areas are located in the flatwood regions with 40.9 percent of the northern ranches and 55.8 percent of the southern ranches. Cattle ranching dominates in the flatwood areas because the same land can not easily be used for citrus groves. As a result of periodic freezes, the citrus industry has moved further south, where new technologies are used to plant on flatwood soils. The southern flatwoods, in their natural state, are usually strewn with pine trees, saw palmetto, gallberry, and wiregrasses.

Table 5.11 Soil types present on ranches.

Soil Type	Northern Rancher Percent in Each Category	Southern Rancher Percent in Each Category
Muck (Organic)	0.0	15.9
Flatwood	40.9	55.8
Deep Sand	31.8	18.2
Loam/Sandy Loam	52.2	38.6
$\chi^2 = 32.655$	Pr = 0.001	

The endangered plants and animals of the southern flatwoods area include the following plants: yellow squirrel-banana, Florida bear grass, wiregrass, mock pennyroyal, Edison's ascyrum, fall flowering ixia, Bartram's ixia, mammals such as the Florida black bear, the fox squirrel the Florida panther; such birds as the Florida grasshopper sparrow, red-cocked woodpecker, bald eagle, Florida sandhill crane, and the burrowing owl (Mullahey and Tanner, 1992).

Differences in the importance of ranching as a primary source of income and the tendency of south Florida's ranches to be generally more dependent on ranching are well illustrated in Table 5.12. In north Florida, land used for permanent pasture constituted 74 percent of the total acreage of the ranches in the sample.

Table 5.12 Pasture type by region.

Pasture Type (PT)	Northern Rancher Percent in Each Category	Southern Rancher Percent in Each Category
Improved Pasture	57	31
Permanent Pasture	74	91
Unimproved Pasture	17	60
Statistics for Table 5.12	$\chi^2 = 30.265$	Pr = 0.001

In south Florida, permanent pasture makes up 91 percent of the total acreage on the ranches included in the sample. As one would expect, unimproved pasture and native range were much more prevalent in south Florida, accounting for 60 percent of all land on the ranches. In north Florida, by contrast, unimproved pasture constitutes only 17 percent of all land. Conversely, improved pasture comprises 31 percent of the land included in the sample in south Florida ranches. However, 57 percent of the north Florida sampled ranch land was improved pasture.

Water and Nutrient Management Concerns

Florida ranchers use water primarily as drinking water for cattle. Water constraints are among the issues legislative policy makers are reviewing. Another concern is whether or not the cattle industry is polluting the aquatic systems with

animal wastes. Only 17.1 percent of ranchers in the north supply drinking water from surface sources. In the southern part of the state, 60.5 percent of the cattlemen use surface sources of water.

Table 5.13 Drinking water sources by region.

Drinking Water Source	Northern Rancher Percent Using Source	Southern Rancher Percent Using Source
Pumped	82.9	39.5
Surface Water	17.1	60.5
Statistics for Table 5.13	$\chi^2 = 39.661$	Pr = 0.001

Where surface water sources are used some potential for contamination by animal wastes exist if animals or their wastes come into contact with the surface water. Very few ranchers, (13.0 percent in the north and 5.8 percent in the south) use meters to determine the volume of water consumption (Table 5.14).

Table 5.14 Ranch water source metering.

Metered or Not?	Percent of Northern Ranchers Who Have/ Do Not Have Water Meter	Percent of Southern Ranchers Who Have/ Do Not Have Water Meter
Yes	13.0	5.8
No	87.0	93.2
Statistics for Table 5.14	$\chi^2 = 2.155$	Pr = 0.142

Management of Nutrients

It is preferable that soil testing be done at the beginning of a pasture cycle. Soil testing is a low cost process, however, 43.5 percent of the northern ranches and 51.5 percent of the southern ranches rarely test their soils (Table 5.15). Soil testing offers instant financial advantage if fertilizer application rates can be reduced.

Selecting the best pasture rotations or planting schedules for the Florida climatic and soil conditions demands comprehensive and careful estimation of crop response and definitive soil management decisions.

Soil testing is one way to estimate nutrient needs and calculate fertilizer requirements (Table 5.16). The survey reveals that a little over a third of the ranchers throughout the state test their soil as part of their pasture management processes.

Table 5.15 Soil testing by region.

Response	Northern Rancher Percent Response	Southern Rancher Percent Response
Almost Always	39.1	34.8
Usually	0.0	11.4
Sometimes	17.4	2.3
Rarely	43.5	51.5
Statistics for Table 5.15	$\chi^2 = 2.389$	Pr = 0.001

Respondents were asked about keeping records of the application of fertilizers (nitrogen phosphate, and/or potassium). Fifty percent of the ranchers in the southern region rarely keep records concerning application of fertilizer to their pastures or hay fields. Whereas 34.8 percent of the northern ranchers seldom keep records of their rates of fertilizer application (Table 5.16). Florida ranchers were also asked if they kept records of the nutrient content of their pastures or hay fields. In north Florida, 52.2 percent of the ranchers rarely keep those kinds of records. The southern ranchers answered (75 percent) that they rarely keep records concerning the nutrient content of the pastures. Similarly, 69.6 percent of northern ranchers rarely keep yield records for pasture and hay fields, and in the south, that percentage is 75.7.

Table 5.16 Frequency with which fertilizing records are kept.

Record Keeping Scale	Keep Fertilizer Application Records by Percent		Keep Crop Nutrient Content Records by Percent		Keep Crop Yield Records by Percent	
	North	South	North	South	North	South
Almost Always	34.8	38.6	17.4	9.1	8.7	15.3
Usually	8.7	11.4	4.3	2.3	21.7	4.7
Sometimes	21.7	0.0	25.1	13.6	0.0	2.3
Rarely	34.8	50.0	52.2	75.0	69.6	75.7
Total	100	100	100	100	100	100
Statistics for Fertilizer Application		$\chi^2 = 24.984$			Pr = 0.001	
Statistics for Nutrient Content		$\chi^2 = 11.228$			Pr = 0.011	
Statistics for Pasture Yield		$\chi^2 = 15.892$			Pr = 0.001	

Application rates of nitrogen were low in both the northern and southern regions. In the northern counties surveyed, 40 percent of the pastures were fertilized with 41-60 pounds per acre. The application rates in the south were lower; 52 percent of those surveyed used between 41 and 60 pounds per acre (Table 5.17).

Phosphate and potassium were applied at lower rates. For this reason, the results are generalized for all counties. The application rates of P_2O_5 (phosphate) were very low in both the northern and southern regions, with surveyed, 50.2 percent of

the pastures in the northern counties being fertilized with only 10-20 pounds per acre and 42 percent in the south (Table 5.18).

Table 5.17 Nitrogen application rates by region.

Pounds/Acre of Nitrogen	Northern Rancher Percent within Range	Southern Rancher Percent within Range
10-20	2.9	5.9
21-40	11.5	11.8
41-60	40.0	52.9
61-80	2.9	5.5
81-100	14.3	3.9
101-120	8.4	0.0
121-140	3.0	0.0
141-160	8.6	11.8
161-180	5.7	2.6
181-200	2.718	4.6
Total	100	100
Statistics for Nutrient Content	$\chi^2 = 11.228$	Pr = 0.011

Application rates of potash (K_2O) were again, very low in both regions. In the northern counties surveyed, 89.57 percent of the pastures were not fertilized with potash at all (Table 5.19).

Of the southern region's ranchers 83.5 percent did not use K_2O on their pastures or hay fields (Table 5.19). In north Florida, 7,738 acres, or 61 percent of the land devoted to pasture and hay production, was fertilized in 1993.

Table 5.18 P_2O_5 application rates by region.

Pounds/Acre of P_2O_5	Northern Rancher Percent within Range	Southern Rancher Percent within Range
0	24.8	0.0
10-20	50.2	42.1
21-40	25.0	38.4
41-60	0.0	7.6
61-80	0.0	5.3
81-100	0.0	5.6
Total	100	100
Statistics for Pounds/Acre of P_2O_5	$\chi^2 = 29.143$	Pr = 0.001

Nitrogen application rates averaged 122 pounds per acre on those acres that were fertilized and P_2O_5 application averaged 34 pounds per acre. Application rates were even lower in south Florida.

Table 5.19 K_2O application rates by region.

Pounds/Acre of K_2O	Northern Rancher Percent within Range	Southern Rancher Percent within Range
0	89.57	83.5
10-20	2.98	0.00
21-40	7.45	0.00
41-60	0.00	0.00
61-80	0.00	5.50
81-100	0.00	11.0
Total	100	100
Statistics for Pounds/Acre of K_2O	$\chi^2 = 27.112$	Pr = 0.001

Only 32 percent of all pasture and hay lands were fertilized. Nitrogen application rates averaged 52 pounds per

acre and P_2O_5 rates averaged only 14 pounds per acre. In north Florida there is the propensity to grow forage that is not native to the state, (rye, rye grass, Bermuda grass, Bahai grass, and some native grasses mixed). These improved grasses require more nutrients than native pastures.

Pasture Renovation and Protection of Endangered Plant Species

Florida ranchers use a variety of methods of renovation. Pasture renovation is accomplished by mechanical methods. There are concerns as to whether this method of renovation is a threat to rare and endangered species.

Table 5.20 Use of mechanical procedures of pasture renovation by region

Mechanical Renovation or Not?	Northern Rancher Percent Using Mechanical Renovation	Southern Rancher Percent Using Mechanical Renovation
Yes	35.0	51.2
No	65.0	48.8
Total	100	100
Statistics for Mechanical Renovation	$\chi^2 = 27.112$	Pr = 0.001

About half, 51.2 percent of southern ranchers use mechanical methods of soil renovation, while fewer, only 35

percent of the northern livestock producers renovate mechanically.

Pesticide Management and Weed Control

Burning has traditionally been a method of weed management for some Florida ranchers. This practice may endanger some species in that their habitat for breeding and food supply may be destroyed. Most, 82.6 perecent, northern ranchers do not burn their pasture. Fewer, 52.3 percent, southern ranchers never burn.

Table 5.21 Florida ranchers who burn their pastures by region.

Response	Northern Ranchers Percent Asked if They Burn Pasture	Florida Ranchers Percent Asked if They Burn Pasture	Southern Ranchers Percent Asked if They Burn Pasture
Every Year	0.0	4.5	4.5
Every Other Year	4.3	14.4	20.5
Every Three Years	13.1	18.4	22.7
Never	82.6	62.7	52.3
Total	100	100	100
Statistics for Pasture Burning	$\chi^2 = 24.504$		Pr = 0.001

Livestock producers in the state of Florida use small amounts of herbicides, mostly spot applications to remove clumps of soda apple, coffee weed, and dog fennel.

Table 5.22 Herbicide application by region.

Frequency of Application	Herbicide Application to Improved Pasture by Percent	
	North	South
Yes	11.9	5.9
No	88.1	94.1
Statistics for Herbicide Application	$\chi^2 = 2.20$	Pr = 0.136

The survey asked if the livestock producer had applied pesticides of any sort, specifically herbicides, to unimproved or native range on their ranch land during the last five years (Table 5.22). In south Florida 5.9 percent of the ranchers in the survey reported applying pesticide. There was more herbicide use in north Florida; 11.9 percent of ranchers in this region of the state indicated that they had applied herbicides.

The southern livestock producers are less inclined to apply pesticides or herbicides to their pastures than their northern colleagues. The survey revealed that 40.9 percent and 42.9 percent of the northern ranchers applied pesticides and herbicides respectively compared to 25.0 and 26.6 percent in the south (Table 5.23). Ranchers are not responsible for the use of safety equipment by custom applicators. Of the northern livestock producers surveyed who apply their own pesticides,

15 percent almost always wear gloves when applying pesticides, 5 percent almost always wear boots, and 20 percent almost always wear a respirator.

Table 5.23 Ranchers who apply pesticides or herbicides.

Pest Management Method	Percent of Ranchers who Apply in the Northern Region	Percent of Ranchers who Apply in the Southern Region
Pesticide	40.9	25.0
Herbicide	42.9	26.6

In the southern region, the surveyed livestock producers revealed that 11.5 percent always wear gloves when applying pesticides, 7 percent wear boots and 4.5 percent always wear a respirator.

Table 5.24 Pesticide application and health protection usage.

Frequency of Application	Rubber Glove Usage by Percent Pr = 0.154		Rubber Boot Usage by Percent Pr = 0.061		Respirator Usage by Percent Pr = 0.001	
	North	South	North	South	North	South
Almost Always	15.0	11.5	5.0	7.0	20.0	4.5
Usually	5.0	7.2	15.0	4.7	5.0	1.3
Sometimes	5.0	2.6	10.0	4.6	0.0	4.7
Rarely	10.0	2.7	5.0	7.0	10.0	7.0
Does Not Apply	65.0	75.0	65.0	75.7	65.0	82.5
Total	100	100	100	100	100	100

The Future of Florida Ranching

Florida ranchers were asked how important the following factors are to the future of Florida ranching: (1) decreasing beef consumption, (2) foreign beef production, (3) pressure from animal rights groups, (4) rising land values, (5) rising property taxes, (6) availability of labor, (7) government regulations about land use, and (8) government labor regulations. Their responses revealed that Florida ranchers are aware of the external forces affecting their business (Table 5.25).

Table 5.25 Overview of Florida rancher concerns by importance.

Issues of Concern	Percent of No. Ranchers Consider Issue Very Important	Percent of So. Ranchers Consider Issue Very Important	Percent of No. Ranchers Consider Issue Not Important	Percent of So. Ranchers Consider Issue Not Important
Consumption of Beef	73.9	75	6.1	2.3
Animal Rts. Groups	56.5	54.0	8.7	2.3
Rising Taxes	69.6	70.5	4.3	4.5
Land Use Regulation	86.4	77.3	9.1	11.4
Environ. Regulation	86.4	79.5	4.5	9.1
Labor Regulations	47.8	52.3	4.3	15.9
Statistics for Rancher Concerns	$\chi^2 = 1.529$ Pr = 0.021		$\chi^2 = 12.828$ Pr = 0.012	

Each of these factors was ranked on a scale of 1 to 4 (Very Important to Not At All Important). Table 5.25 ranks the ranchers' responses according to this scale. The combined responses of 1 and 2 (Very Important and Important) and 3 and 4 (Not Very Important and Not At All Important), reveal that the ranchers questioned tended to rank the two very high. The "environmental and regulatory issues" included in the list of factors, 86.4 of northern ranchers and 79.5 of southern ranchers found environmental regulation very important. Ranchers seem to feel that environmentalists cause a great many of their problems. This was expressed in most of the discussions with the southern Florida ranchers and the larger cattle ranchers in north Florida.

Ranchers also indicated how the following factors affected profitability: (1) beef prices, (2) labor costs, (3) costs of inputs, (4) veterinary care expenses, (5) cost of equipment, (6) interest rates, (7) investments required to meet environmental safety standards, and (8) cost of keeping records for the government. Ranchers in both regions considered beef prices and the cost of inputs as having the greatest impact on the profitability of their operations. Nonetheless, their investments required to meet environmental safety standards and the cost of keeping records ranked nearly as high in both cases.

Results indicate that cattle ranchers in Florida believe they are using many production practices which are environmentally benevolent.

Table 5.26 Florida rancher concerns about profitability by region.

Issues of Concern	Percent of No. Ranchers Consider Issue Important	Percent of So. Ranchers Consider Issue Important	Percent of No. Ranchers Consider Issue Not Important	Percent of So. Ranchers Consider Issue Not Important
Beef Prices	100	91	0	9
Environmental Standards	74	86	26	13
Equipment Costs	57	86	13	14
Input Costs	98	93	2	7
Record Keeping	87	87	13	38
Average Percentages	83	89	11	15
Statistics for Entire Table	$\chi^2 = 84.76$	Pr = 0.001		
Statistics for Whether Issue is Important	$\chi^2 = 6.49$	Pr = 0.165		
Statistics for Whether Issue is Not Important	$\chi^2 = 23.96$	Pr = 0.001		

The data also indicate that they are concerned about the potential impact of environmental issues and government regulations on both individual ranch profitability and the

future of ranching in the state. Unfortunately, results also show that most ranchers are probably not monitoring their ranch operations effectively to prove that they are environmentally sound, as the data about record keeping discussed earlier show.

Table 5.27 Importance of factors to ranchers by region.

Response Range	Land Use Concerns by Percent Response t=1.43		Environmental Concerns by Percent Response t=1.37		Labor Regulations Concerns by Percent Response t=2.73	
	North	South	North	South	North	South
Very Important	85.4	77.3	85.4	79.5	47.8	52.3
Important	4.5	5.8	9.1	4.5	30.4	18.2
Not Very Important	0.0	4.5	0.0	5.8	17.4	13.6
Not at all Important	9.1	11.4	4.5	9.2	4.4	15.9
Total	100	100	100	100	100	100

Changes of Agricultural Land Use into Urban Land Use

Nine of the twelve fastest growing metropolitan areas in the 1980s were in Florida. The others were in California, Nevada, and Texas. Naples, Florida, grew by 77 percent during

the decade, making it the fastest growing metropolitan area in the United States. The redistribution of metropolitan population that took place on a statewide scale in the twentieth century occurred in the context of a rapidly changing economy which was shifting from an agrarian and light industry base to a postindustrial service and/or high-technology base (Florida Statistical Abstract, 1987, 1990).

During the period of 1973 through 1984, both population and the extent of urban land increased substantially. The amount of urban land in Florida (excluding Dade and Monroe counties) increased by 1,456,079 acres (Table 5.28). The increase in urban land in MSA counties was 2.6 times the measure of land converted to urban uses in the non-MSA counties. Therefore, the land converted to urban uses per person was higher in the non-MSA counties than in MSA counties.

The urban land use coefficients for MSA and non-MSA counties are presented in Table 5.29. These coefficients represent the amount of land converted to urban uses for each additional person added to the population base from 1973 to 1984. The urban land use coefficient for MSA counties in Florida was 0.435. That is, during that period, the amount of land converted to urban use amounted to 0.436 acres for each added person.

The data reveal that the land use and population settlement patterns differ regionally between the central and southern region versus the northern region of the state.[1] The urban land use coefficient for the MSA counties in the north was found to be 0.803 acres per person, whereas the coefficient for the MSA counties in the central and south was 0.347 acres per person.

Table 5.28 Population changes in MSA and non-MSA counties between 1973 - 1984.

	MSA Counties	Non-MSA Counties	Florida
Urban Land			
1973	1,445,069	240,483	1,685,552
1984	2,499,936	641,695	3,141,631
Change	1,054,867	401,212	1,456,079
Population			
1973	5,785,150	609,987	6,395,137
1984	8,206,926	910,958	9,117,884
Change	2,421,776	300,971	2,722,747

The MSAs in the central and southern counties are more densely populated, land values are higher, and there is stronger competition for land (Table 5.29). Population growth in Florida has resulted in the conversion of natural and rural

[1] The northern region is comprised of the Ocala, Gainesville, Jacksonville, Tallahassee, Panama City, Ft. Walton Beach, and Pensacola MSAs. The central and southern region include the Miami, Hialeah, Ft. Lauderdale, Hollywood, Pompano Beach, West Palm Beach, Ft. Pierce, Naples, Ft. Myers, Cape Coral, Sarasota, Bradenton, Tampa, St. Petersburg, Clearwater, Lake Winter Haven, Orlando, Melbourne, Titusville Palm Bay, and Daytona Beach MSAs.

land to urban land uses at higher rates than in other areas in the United States.

Urban land use in the non-MSA counties was 1.33 acres, about three times higher than the coefficient of MSA counties. The coefficient for non-MSA counties in the north is 2.026 acres per person, which is almost three times the coefficient in the central and south (0.682). Other studies have also found that urban land use coefficients are consistently higher in non-MSA counties.

Table 5.29 The urban land use coefficients.

Region	MSA Counties Acres/Person	Non-MSA Counties Acres/Person
Florida	.436	1.333
South	.347	.682
North	.803	2.026

Results of Pasture Land Use Analysis

The entire state of Florida comprises 34,660,480 acres. The state is divided into northern and southern regions for this section of the analysis.

The northern region consists of the following counties:

> Volusia, Putnam, Clay, Citrus, Sumter, Dixie, Lake, Taylor, Orange, Leon, Seminole, Okaloosa, St. Johns, Holmes, Levy, Flagler, Jefferson, Pasco, Jackson, Bradford, Madison, Gulf, Bay, Gilchrist, Columbia, Duval, Alachua, Suwannee, Union, Washington, Franklin, Gadsden, Liberty, Hernando, Marion, Walton, Lafayette, Wakulla, Calhoun, Hamilton, Santa Rosa, Nassau, Baker, and Escambia.

The southern region includes the following counties:

> Polk, Collier, Sarasota, Charlotte, Broward, Brevard, St. Lucie, Pinellas, Hardee, Glades, Lee, Indian River, Highlands, Hillsborough, Hendry, Manatee, Osceola, Palm Beach, Dade, De Soto, Martin, Monroe, and Okeechobee.

Florida pastures are concentrated in the southern part of the state (Table 5.30). Cattle will not only affect the demand for pasture and rangeland but also the demand for cropland.

Table 5.30 Pasture and range land acreage by region.

Region	Pasture and Range, 1987	Pasture and Range, 1990
Northern Counties	1,248,288	1,254,888
Southern Counties	3,623,439	3,296,446
Total	4,871,727	4,551,334

Even if we accept the likelihood that the national and international demand for beef will rise no more than 0.5 or 1 percent annually, there remains the possibility that the

various economic, political, and social forces that determine how cattle are raised will cause the industry to expand disproportionately within Florida. Between 1987 and 1990, however, the surface of pasture and range land decreased substantially in the north and less so in the south (Florida Statistical Abstract, 1987). The amount of pasture and range land in Florida decreased by 320,393 acres (Table 5.31) in the period 1987 to 1990. Obviously, the land converted from pasture has gone into some other use. The previous analysis concerning urbanization supports the hypothesis that the land use conversion in the north has been largely to urban development. In south Florida, both urbanization and agricultural diversification account for the conversion. In the north, ranching occupied 1 percent more of its counties' 1990 pasture acreage than in 1987 (Table 5.31). In the south, approximately 3 percent of the counties pasture acreage has gone into some other use.

Table 5.31 Pasture and range land coefficients by region.

Region	Coefficients of County Pasture and Range: 1987	Coefficients of County Pasture and Range: 1990
Northern Counties	5.79	7.09
Southern Counties	23.95	20.81

When examining the land use coefficients for pasture land in the northern counties of the state, for every acre of pasture there was approximately 5.79 acres of county acreage in 1987 and 7.09 acres of county land for every acre of pasture land in 1990. In the south, for every acre of pasture there was 23.95 acres of county acreage in 1987. In 1990, for every acre of pasture there was 20.81 acres of county acreage in 1990. The southern region had more land in their counties not involved in cattle ranching, despite having larger ranches associated with larger herd sizes.

Herdsize Change Indices

Changes in county cattle herdsizes between the years 1982 and 1990 were examined. The indices generated by a proportional evaluation revealed that for every head of cattle in the southern region in 1982, a decrease of approximately 0.39 in southern counties (Table 5.32a). In the north, for every head of cattle there was a 0.25 increase in county herds.

This decrease in herd size in the south would at first seem to show that Florida is losing part of its cow/calf industry. However, Florida is still producing at levels that meet the present demand. By the time this analysis was concluded, greater proportional increases in herdsizes are

found mostly in the southern portion of the state. This analysis serves to develop the objectives of the location quotient as it further explains what is occurring within counties along with land uses (Figures 5.1 and 5.2).

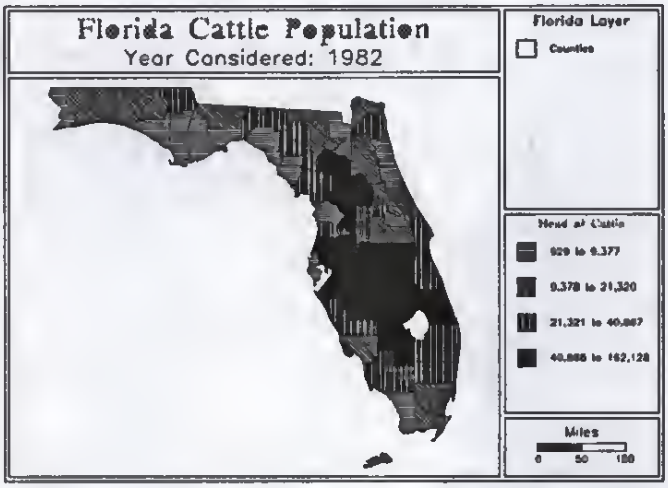

Figure 5.1 Florida cattle location by herdsize in 1987.
Source: Florida Statistical Abstract, 1987.

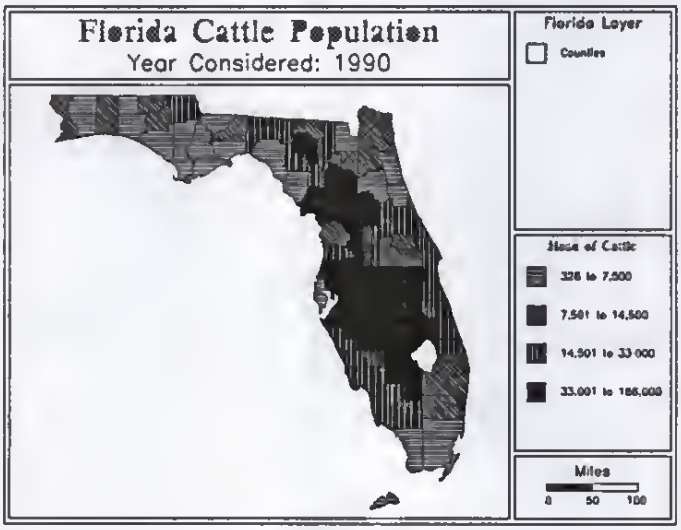

Figure 5.2 Herdsize by county in 1990.
Source: Florida Statistical Abstract, 1990.

Table 5.32 Herdsize changes compared using a proportional index.

County	Cattle 1982	Cattle 1990	Index	Region
Hardee	74,888	108,000	0.31	South
Brevard	24,849	33,000	0.25	South
Seminole	7,485	9,500	0.21	South
De Soto	71,327	82,000	0.13	South
Okeechobee	162,128	186,000	0.13	South
Lee	13,527	15,000	0.10	South
Highlands	97,525	103,000	0.05	South
Pasco	50,615	50,000	-0.01	South
Polk	113,731	111,000	-0.02	South
Charlotte	29,047	28,000	-0.04	South
Citrus	8,871	8,500	-0.04	South
Lafayette	22,791	22,000	-0.04	South
Glades	68,654	65,000	-0.06	South
Hendry	133,501	117,000	-0.14	South
Manatee	71,581	63,000	-0.14	South
Osceola	117,870	101,000	-0.17	South
Indian River	31,528	26,000	-0.21	South
Hillsborough	85,379	70,000	-0.22	South
Hernando	29,243	22,000	-0.33	South
Sarasota	38,691	23,000	-0.68	South
St. Lucie	53,514	31,000	-0.73	South
Dade	10,678	5,500	-0.94	South
Collier	29,571	15,000	-0.97	South
Broward	27,239	11,000	-1.48	South
Palm Beach	37,659	11,000	-2.42	South
Pinellas	1,549	409	-2.79	South
Totals	**1,413,441**	**1,316,909**	**-0.39**	**Average**

Table 5.32b Herdsize changes compared using a proportional index.

County	Cattle 1982	Cattle 1990	Index	Region
St. Johns	4,977	5,500	0.10	North
Okaloosa	10,065	11,000	0.09	North
Escambia	9,377	10,000	0.06	North
Lake	28,058	30,000	0.06	North
Levy	32,541	34,000	0.04	North
Union	10,067	10,500	0.04	North
Alachua	46,322	48,000	0.03	North
Calhoun	4,933	5,000	0.01	North
Bay	929	900	-0.03	North
Bradford	9,115	8,500	-0.07	North
Nassau	14,487	13,500	-0.07	North
Baker	5,958	5,500	-0.08	North
Taylor	6,097	5,500	-0.11	North
Marion	58,953	52,000	-0.13	North
Washington	13,521	12,000	-0.13	North
Sumter	58,280	50,000	-0.17	North
Jackson	39,656	33,000	-0.20	North
Suwannee	40,801	34,000	-0.20	North
Leon	12,156	10,000	-0.22	North
Liberty	1,479	1,200	-0.23	North
Volusia	18,639	15,000	-0.24	North
Jefferson	23,322	18,500	-0.26	North
Orange	18,335	14,500	-0.26	North
Clay	18,038	14,000	-0.29	North
Columbia	21,320	16,500	-0.29	North
Madison	22,215	17,000	-0.31	North
Santa Rosa	9,897	7,500	-0.32	North
Holmes	19,721	14,500	-0.36	North
Hamilton	12,476	9,000	-0.39	North
Flagler	9,125	6,000	-0.52	North
Gilchrist	40,867	26,000	-0.57	North
Martin	52,028	31,000	-0.68	North
Gadsden	13,617	6,500	-1.09	North
Putnam	15,091	7,000	-1.16	North
Walton	17,122	7,500	-1.28	North
Duval	29,678	12,500	-1.37	North
Dixie	9,175	3,700	-1.48	North
Totals	758,438	606,800	-0.33	Average

Table 5.32c Herdsize changes compared using a proportional index.

County	Cattle 1982	Cattle 1990	Index	Region
Monroe	1,234	483	-1.55	North
Gulf	1,453	456	-2.19	North
Franklin	1,157	328	-2.53	North
Wakulla	1,600	365	-3.38	North
Totals	**5,444**	**1,632**	**-2.41**	**Average**

Application of the Location Quotient to Pasture Acreage

A location quotient equal to 1 means the acreage has exactly the same relative frequency for pastures as is found across the entire state. A location quotient greater than 1 indicates that pastures are overrepresented in the acreage and hence has a large relative concentration in pasture acreage. The higher the location quotient value, the greater the degree of concentration of acres in pasture within a given county.

Table 5.33 Location quotients of four selected counties (1987, 1990).

County	Location Quotient 1987	Location Quotient 1990	Region
Pinellas	1.03	0.76	South
Hernando	0.59	0.57	North
Highlands	2.91	3.11	South
Okeechobee	3.06	3.28	South

A location quotient less than 1 shows an underrepresentation of acres in pasture. This measure can be used to compare different county's pasture acreage, or a county's pasture acreage at different points in time.

The results in these examples suggest that, in comparison with the ratio of pasture land for the state as a whole, the percentage of county pasture land contained in (a) Pinellas county is approximately equivalent, and relatively decreases in pasture land acreage in 1990 (b) Hernando county has a substantially lower location quotient, (c) Highlands county is noticeably greater, and (d) Okeechobee county is slightly higher. As pasture land changes into another form of land use in one area, the change positively affects the location quotient in all the counties within the state.

LQ is a convincing method of measurement since it is independent of scale. The location quotient allows observations made for different situations to be compared, since they are standardized by their overall map scope. Any departure from unity will have proportional results, regardless of the phenomenon involved (Table 5.34a and 5.34b). This is a measure based upon count data and is centered around unity. Under-representation is condensed into the interval (0, 1), while over-representation is

unrestricted in the interval (1, ∞). Figures 5.3 and 5.4 for 1987 and 1990 reveal the distribution of the location quotients of the over-represented category with an interval of (1, ∞), located in the southern region of the state. The LQ indicates regional differences in proportion of pasture used by county by the cow/calf industry in Florida.

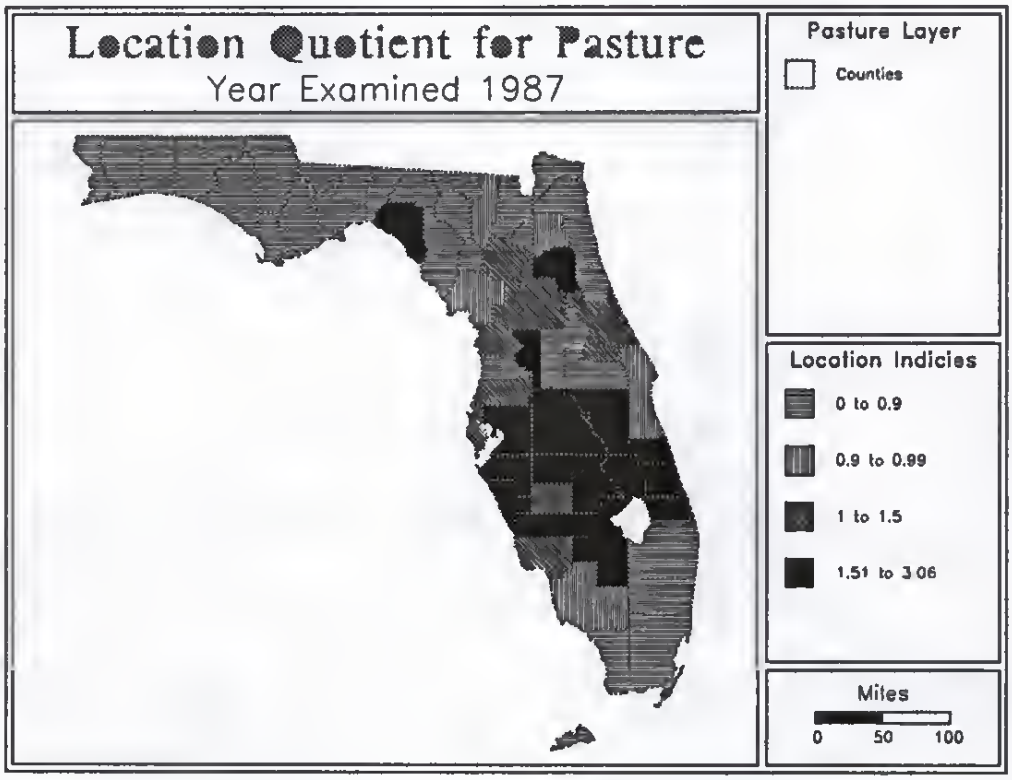

Figure 5.3 Location quotient for state and county pasture land in 1987. Source: Florida Statistical Abstract, 1987.

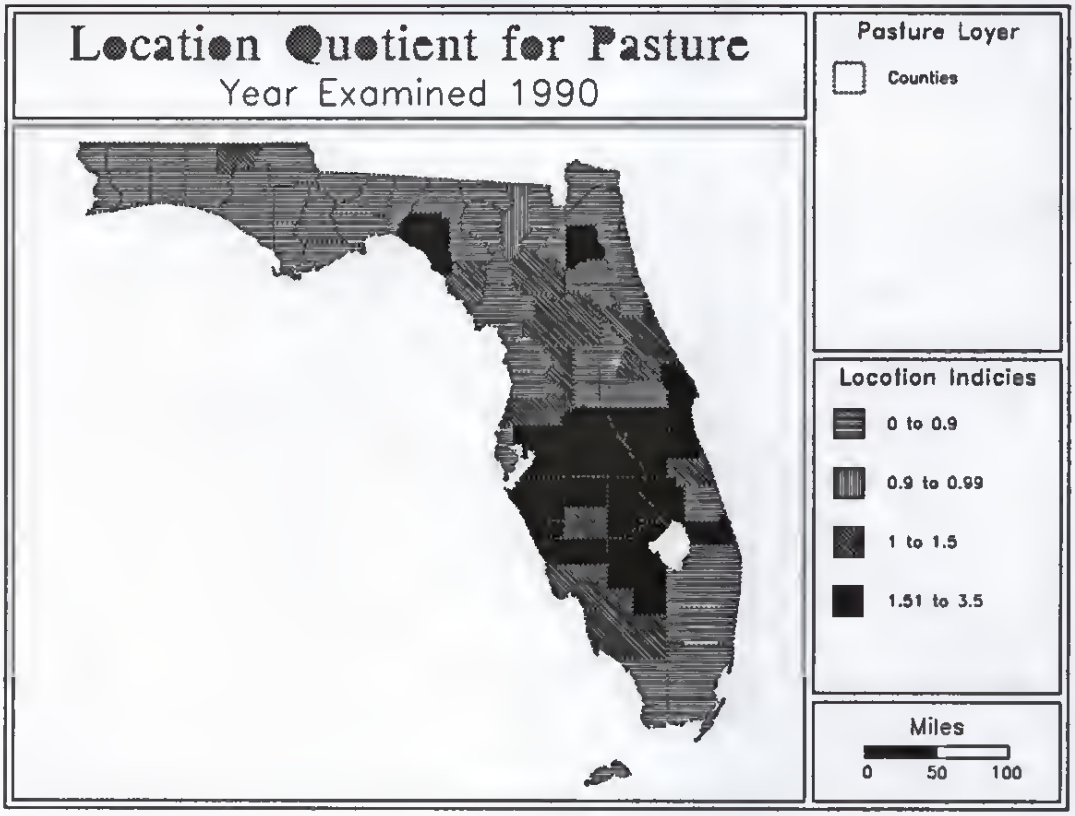

Figure 5.4 Location quotient for state and county pasture land in 1990. Source: Florida Statistical Abstract, 1990.

Table 5.34a Location quotients of pasture land by county and region.

COUNTY	Quotient 1987	Quotient 1990	Change Points	Region
Brevard	0.99	3.40	2.41	South
Clay	0.94	3.01	2.07	South
Dixie	0.52	1.50	0.98	North
Osceola	2.03	2.74	0.71	South
Holmes	0.34	1.02	0.68	North
Taylor	1.58	2.25	0.67	North
Bradford	0.00	0.61	0.61	North
Gilchrist	0.35	0.58	0.23	North
Martin	3.06	3.28	0.22	South
Highlands	2.91	3.11	0.20	South
Palm Beach	0.11	0.27	0.16	South

Table 5.34b Location quotients of pasture land by county and region.

COUNTY	Quotient 1987	Quotient 1990	Change Points	Region
Alachua	1.17	1.32	0.15	North
Volusia	1.26	1.35	0.09	North
Seminole	1.19	1.28	0.09	North
Charlotte	1.72	1.80	0.08	South
Gadsden	0.04	0.11	0.07	North
Franklin	0.02	0.09	0.07	North
Hendry	1.86	1.93	0.07	South
Marion	1.08	1.15	0.07	North
Lake	0.64	0.68	0.04	North
Wakulla	0.12	0.16	0.04	North
Orange	0.55	0.59	0.04	South
Leon	0.56	0.60	0.04	North
Flagler	0.55	0.59	0.04	North
St. Johns	0.54	0.58	0.04	North
Collier	0.98	1.01	0.03	South
Hardee	1.88	1.90	0.02	South
Okaloosa	0.36	0.38	0.02	North
Calhoun	0.08	0.10	0.02	North
Walton	0.02	0.04	0.02	North
Union	0.20	0.22	0.02	North
Jefferson	0.33	0.35	0.02	North
Jackson	0.18	0.19	0.01	North
Hamilton	0.08	0.09	0.01	North
Suwannee	0.08	0.09	0.01	North
Duval	0.07	0.08	0.01	North
Dade	0.03	0.03	0.00	South
Broward	0.02	0.02	0.00	South
De Soto	1.03	1.03	0.00	North
Bay	0.11	0.11	0.00	North
Baker	0.03	0.03	0.00	North
Liberty	0.03	0.03	0.00	North
Nassau	0.01	0.01	0.00	North
Escambia	0.00	0.00	0.00	North
Monroe	0.00	0.00	0.00	North
Santa Rosa	0.00	0.00	0.00	North
Columbia	0.98	0.97	-0.01	North
Lafayette	0.41	0.39	-0.02	North
Hernando	0.59	0.57	-0.02	North
Hillsborough	2.88	2.83	-0.05	South
Washington	0.08	0.00	-0.08	North
Lee	1.20	1.05	-0.15	North
Madison	0.70	0.55	-0.15	North

Table 5.34c Location quotients of pasture land by county and region.

COUNTY	Quotient 1987	Quotient 1990	Change Points	Region
Pasco	1.40	1.23	-0.17	North
Gulf	0.30	0.11	-0.19	North
Levy	0.91	0.70	-0.21	North
Pinellas	1.03	0.76	-0.27	South
Manatee	2.83	2.54	-0.29	South
Okeechobee	3.01	2.45	-0.56	South
Indian River	1.60	1.00	-0.60	South
Glades	2.26	1.64	-0.62	South
Sarasota	2.93	2.31	-0.62	South
Polk	2.79	1.96	-0.83	South
Sumter	2.58	1.27	-1.31	North
Citrus	1.40	0.06	-1.34	North
St. Lucie	2.44	0.61	-1.83	South
Putnam	2.43	0.57	-1.86	North

CHAPTER 6

CONCLUSIONS

This dissertation has described the conditions under which the Florida calf and cow industry has developed. The survey-generated data suggested that ranching in Florida is largely an environmentally protective agricultural activity. However, further steps should be taken, using a systems approach, to address issues of sustainability for cattle ranching in Florida. A systems approach permits examination of complex interactions between each subsystem (i.e., cattle ranching, dairy farming, truck farming, and urban land use).

As mentioned in the introduction, one goal of this study was to describe the major land uses in Florida and their environmentally deteriorating effects. Despite the controversy concerning livestock based production systems, the data tends to support the view that Florida's livestock industry has relatively little potential for detrimental environmental impact compared to other agricultural systems. Furthermore, the survey results show that Florida's ranchers are well aware

of the environmental issues involving the beef business and are concerned about them.

The main objective of this study was to gain an understanding of demographic factors and specific information about ranchers and their operation. The mean age of the ranchers sampled in North Florida is 51 years. In South Florida, the mean age is 57. In the northern region, 47.5 percent of those surveyed had over 30 years of experience in the cattle business and in the southern region 67.1 percent of those surveyed had over 30 years of experience. The southern cattle ranchers are somewhat older than those in the northern region.

As to the use of available resources such as water, irrigation is not an issue for most Florida ranchers. Very few of those surveyed irrigate their pastures. In the north, some of the cattle's drinking water, 17.1 percent is drawn from surface sources, but most is drawn from wells. In the southern part of the state, 60.5 percent of the ranchers surveyed use surface sources of water. Nitrogen application rates were low in both the northern and southern region. Across all counties surveyed, 35 percent of the ranchers applied more than 60 pounds of nitrogen fertilizer per acre and 65 percent applied less than 60 pounds per acre. Application rates in south Florida are lower; 52 percent of those surveyed apply

between 41 and 60 pounds per acre. At these application rates contamination of surface and sub-surface water is not a high risk. This study revealed that the ranchers make good use of available technology in their ranch management. They are also well aware of external forces that affect the future of the cattle industry financially and politically. The questionnaire asked ranchers about the importance of several factors such as government regulations, foreign beef production, decreasing beef consumption, rising land values, and availability of labor, to the future of ranching in Florida. They were also asked how important beef prices, labor costs, input costs, veterinarian costs, equipment costs, interest rates, record keeping, and environmental safety standards are to profitability. All ranchers, regardless of location, identified four factors as being important for the future of the cattle industry in Florida.

In general, the results of this survey show that Florida's ranchers apply low rates of chemical fertilizer, irrigate very little pasture or forage land, and use modest amounts of pesticides to control weeds and pests. Nonetheless, the results also suggest that ranchers keep relatively few records of the kind that could help establish how they manage their ranches over time. Lack of water meters, water sampling programs, and reliable records on water use make it difficult

to show how ranching in Florida has responded to environmental issues over time. Further, these records could be critical, when used in the future, to establish the kinds of practices that are occurring on the large acreage that is devoted to beef production in the state.

It's easy to forecast a tendency toward more stringent requirements for operations that may ostensibly contaminate ground water or surface water. For a variety of reasons, we live in a time when people are increasingly concerned about all forms of threats to public health and to environmental degradation. Many of these people know very little about beef cattle producers or the beef industry and most of them feel no need to learn. In fact, in the same measure that urban populations are growing they are sending more urban delegates to in the legislature, increasing their control over public policy.

These considerations indicate a greater need for agricultural operators and interests of all kinds to teach, and communicate their concerns. At the same time, is important for agricultural interests to have more credibility among those they wish to influence. This credibility comes with more knowledge, integrity and demonstrated efforts to "do the right things."

A key concept is the capacity of farmers to respond positively to the numerous shifts in the economic, social, political and ecological systems in the midst of which they operate. All agricultural systems are in a state of flux, even "traditional" ones. How ranchers tackle environmental challenges will be critical to the sustainability of ranching over the long term in Florida.

The geographic analysis in this dissertation focuses on the spatial location of ranching. Land coefficients on Florida's cattle/calf industry and urban dynamics are used to examine the relationship between cattle ranching and residential land use. Most areas of Florida are experiencing rapid population expansion and resulting shifts in agricultural production. Florida Metropolitan Statistical Areas are expected to undergo substantial increases in population, resulting in more conversion from pasture to other land uses.

The relatively high rate of urban land conversion in Florida may have serious implications for some areas of the state. Let us assume that the Florida population increases by 2.8 million people from 1990 to 2000, as projected by the Bureau of Economic and Business Research in 1989. According to this projection, population growth in the central and southern portions of the state will bring 2.2 million more people, with

94.3 percent of the population increase occurring in MSA counties. In the north, population is projected to increase by 0.6 million people with 84.9 percent of the growth occurring in MSA counties. With the urban land use coefficients estimated in this study and the population projections by the Bureau of Economic and Business Research in 1989, the amount of land converted to urban uses during the 1990s is expected to be 1,396,555 acres overall, or 126,960 acres per year. The number of acres converted is expected to be less in the smaller MSAs of North Florida, but it is difficult to estimate how much the urban land use coefficients may decrease during this relatively short time span. The relatively low rate of rural land conversion into grazing land in Florida may be an economic indicator for some special areas of the state that are not under urbanizing pressures.

The largest herd sizes are in the southern reaches of the state. The grazing land use coefficient demonstrates that for every acre of county land that is not involved in ranching, there is a proportionate amount of county land that is pasture land. The results indicate that 15 of the 23 southern counties have changed their land use from grazing to some other use. Southern ranchers were diversifying at a rate of 7.3 percent between 1987 and 1990 while northern ranchers are diversifying at a rate of 6.8 percent during the same

period. Between 1987 and 1990 the pasture acreage increased in the north by 4.6 percent of the total land available in the counties, while the percentage in the south, was 13.4. Thus, the southern ranchers are not only diversifying at a faster rate, but also their land under pasture is augmenting faster than that of the north. Truly, the southern cattle industry is exhibiting much more dynamic characteristics than those of the northern cattle industry.

A very significant trend in northern grazing has been the increased use of winter wheat and other minor grain crops on a small scale north of Ocala. In most cases, these are double cropped and seldom irrigated (information gathered through rancher interviews by author, in 1994). With these crops, a farmer can use the land in a single year to produce, for example, a late summer crop of soybeans, allow for winter grazing, and have an early summer harvest of grain.

It seems that there is some interest among southern beef cattle ranchers to keep animals all the way through to slaughter weight (field discussion with several ranchers, 1993). This transition would mean Florida ranchers would have to confront many of the stringent environmental constraints already in place. It is suggested that the recent growth in the southern Florida population and hence the increased market for low fat meat, increased transportation costs, and the

increase in the cost of feed grains have encouraged Florida ranchers to think of investing in alternative meat sources (ostrich, sheep, etc.). Development of a finishing industry in Florida would have its associated consequences as shown by the depletion of the Ogallala Aquifer, which supports irrigated production of much of the grain used in the Great Plains feed lots. The use of the location quotient, herd size indices, land use coefficients and population coefficients revealed that the southern region of the state is experiencing a strong competition for agricultural and urban land.

Land use conflicts and competition of land will persist as an important issue in Florida. Friction between those who own land and want to change its use, and other individuals living in landed properties who do not want the use changed will be a major problem that will take on an urban versus rural aspect. The reason for this dispute is that urban developers view large blocks of land as potential open space, passive recreational outlets, and areas of scenic beauty that should be preserved. Many agricultural land owners who hold this type of land, especially near urban centers, view the property for future urban expansion and development.[1]

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[1] The region of most profound conflict is noted to be south central Florida, an area where both urbanization and agricultural production are intense.

Florida land owners face the possibility of increased legislation and regulation by government. Increased availability to fund growth management programs will most likely accelerate conflicts between land owners and others, and a lack of funds will probably result in less stringent regulation.

The court system will gradually move towards a clearer definition of the taking issue and sustainability issues. A precise definition is not possible at present, but throughout time history has moved towards clarification.

It is important that agricultural land owners become more actively involved in the planning process. This will require an increased effort to educate themselves about existing laws and regulations, about future issues, to attend meetings, hearings and workshops and to formulate the potential impacts associated with proposed planning laws clearly and concisely. The land does not only produce commodities for Florida agricultural land owners, but it generates collateral for operating funds and is an investment for the long term economic well being of the land owner and a source of revenues for the state.

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APPENDIX I
THE SURVEY INSTRUMENT

BEEF CATTLE RESEARCH QUESTIONNAIRE

These questions provide some general information about your farm or ranch.

1. When did you first start raising cattle on this farm? _____ Year

2. Do you sell primarily feeder calves or breeding stock? Check one.
   _____ Feeder calves
   _____ Breeding stock

3. Not including calves, how many animals do you have in your herd today and how many animals did you have in 1983?

Herd Size	1983	1993
Less than 100		
101 - 250		
251 - 500		
501 - 1,000		
1,001 - 2,500		
2,501 - 5,000		
More than 5,000		

4. What is the total acreage of your farm or ranch? How much of this land do you own and how much of it is rented?
   _____ Total acreage
   _____ Owned acreage
   _____ Rented acreage

5. What is the major soil type that you use for pasture land?
   _____ Muck (organic)
   _____ Flatwood
   _____ Deep sand
   _____ Loam/sandy loam

6. Do you or the farm belong to any trade associations?

   _____ Florida Cattlemen's
   _____ Florida Farm Bureau
   _____ Breed association. What?_____
   _____ Other. What?_____

7. How many acres, including both owned and rented acres, of each of the following did you have on your farm in 1993 and in 1983?

Use	Acres 1993	Acres 1983
Permanent Pasture Improved Pasture (cleared, planted to an improved variety, and usually limed and fertilized) Native Range or Unimproved Pasture		
Cool Season Annual Forages (small grains, rye grass, etc., including pasture or hay fields overseeded with cool season annuals, not including forage legumes)		
Hay Fields (not including legumes)		
Warm and Cool Season Forage Legumes (such as white and red clovers, aeschenomenye, hairy indigo, desmodium, etc.)		
Other Forage Crops (silage sorghum, etc.)		
Planted Pines		
How Much of Your Land Do You Consider as Wetland		
Citrus		
Row Crops		
Other What?		

Now we would like some information about the business farm operator.

1. Age _____ Years

2. Sex _____ M _____ F

3. Years of formal education

_____ Years if less than 12
_____ High school diploma
_____ Some college (years?)
_____ Earned a college degree
Area? _____

4. Years experience in managing a beef cattle operation? _____ Years

5. How important are the following sources of information to you? (if a source will keep you in the black then it is very important).

Source	Very Important	Important	Not Very Important	Not At All Important
Extension Agent				
Other University of Florida or IFAS Employees				
Consultant				
Vendor Representative				
Veterinarian				
Trade Association				
Other Cattlemen				

The following questions are about how you use your land.

1. Have you planted any improved pasture since 1983? _____ Yes _____ No

   If NO, please go to the next question.

   If YES, please fill out the chart below. For each area planted in improved pasture since 1983, indicate the year the pasture was planted, how many acres were planted, and the previous land use.

Year Planted	Acres	Previous Land Use		
		Unimproved Pasture	Natural Woodland or Wetland	Other What?

2. Have you planted any citrus on land that was in pasture since 1983? _____ Yes _____ No

If NO, go to next question.

If YES, in which years and how much acreage did you plant in citrus?

	Year	Acres
	_____	_____
	_____	_____
	_____	_____

3. Do you normally graze your livestock in woodland? Check all that apply.

_____ No
_____ Yes, in natural woodland
_____ Yes, in planted pines

4. Do you usually rotationally graze your pasture? _____ Yes _____ No

5. Do you have any mixed grass and legume pastures or hay fields (for example, a mixed desmodium and grass pasture) OR pure stands of legumes? _____ Yes _____ No

If NO to Question 5, please go to the next section.

6. If YES to Question 5, please fill out the chart below. This information is for mixed legume and grass pastures or hay fields or pure stands of legumes ONLY. Please indicate the year that the grass and legume mixture or the pure legume stand was established, how many acres were established, and how you use the field.

Write Type of Grass and/or Legume Below	Year Planted	Acres

We are also interested in some of your pasture management practices.

Questions 1, 2,and 3 apply to native range or unimproved pasture only. If you DO NOT HAVE ANY NATIVE RANGE OR UNIMPROVED PASTURE, please go to question 4.

1. On the average, how often do you burn your native range unimproved pasture or range?

_____ Every year
_____ Every other year
_____ Every 3 years
_____ Less than every 3 years
_____ Never

If NEVER, please go to the next question.

Which month or months of the year do you prefer for burning? Put an "X" on those that apply.

Jn	Fb	Mr	Apr	May	Jun	Jul	Aug	Spt	Oct	Nov	Dec

2. Have you applied any herbicide to your native range or unimproved pasture during the last five years? _____ Yes _____ No
If NO, go to question 3.

Please tell us what kind of weed problems you had, the years you experienced these problems, how many acres were affected, and how many herbicide applications you had to make to correct the problem.

Weed	Year	Acres Affected	No. of Applications

3. Have you used a roller chopper, web plow, disk harrow, or other mechanical means to renovate your native range or unimproved pasture during the last 5 years? _____ Yes _____ No

If NO, go to question 4.

If YES, please tell us the years you renovated, how many acres were renovated, and the month that you renovated.

Year	Month Renovated	Acres Renovated

Questions 4 and 5 apply to improved pasture only. If you DO NOT HAVE ANY IMPROVED PASTURE, please go to question 6.

4. On the average, how often do you burn your improved pasture?

_____ Every year
_____ Every other year
_____ Every 3 years
_____ Less than every 3 years
_____ Never

If NEVER, please go to the next question.

Which month or months of the year do you prefer for burning? Put an "X" on those that apply.

Jn	Fb	Mr	Apr	May	Jun	Jul	Aug	Spt	Oct	Nov	Dec

5. Have you applied any herbicide to your improved pasture during the last five years? _____ Yes _____ No
If NO, go to the next question.

Please tell us what kind of weed problems you had, the years you experienced these problems, how many acres were affected, and how many herbicide applications you had to make to correct the problem.

Weed	Year	Acres Treated	No. of Applications

6. Have you applied any pesticide, including herbicide, to a crop (citrus, vegetables, beans, greens, etc.) on your farm during the past five years? _____ Yes _____ No

If NO, go to the next section about fertilization.

7. What percentage of the pesticides, including herbicides, used on your farm are applied by you, your hired labor, and a custom applicator? *(Please Note: Owner Manager Information found in Question 8, Hired Labor in Question 9, and Custom Applicator in Question 11).*

_____ % Owner or Manager
_____ % Hired Labor
_____ % Custom Applicator

If ALL BY CUSTOM APPLICATOR, please go to Question 11.

8. Please fill out the chart below if the owner or manager applies 25% or more of all pesticides that are used. How often do you use the following clothing and equipment when applying pesticides?

Item	Almost Al ways (>75% of the Time)	Usually (50 - 75% of the Time	Some times (25 - 49% of the Time)	Rarely (< 25% of the Time)
Long sleeved shirt				
Cotton gloves				
Rubber boots				
Rubber gloves				
Respirator				
Full Suit				

9. Please fill out the chart below and answer the question after the chart if hired laborers apply 25% or more of all pesticides that are used. How often do your hired laborers use the following clothing and equipment when applying pesticides?

Item	Almost Al ways (>75% of the Time)	Usually (50 - 75% of the Time	Sometimes (25 - 49% of the Time)	Rarely (< 25% of the Time)
Long sleeved shirt				
Cotton gloves				
Rubber boots				
Rubber gloves				
Respirator				
Full Suit				

How often do you provide training for hired laborers about pesticide safety? Check the one that applies best.

_____ At hiring
_____ Periodically (yearly, for example)
_____ When the need arises

10. If pesticides are loaded into application equipment and/or mixed on your farm, what kind of mixing and loading facility do you have? Check all that apply.

_____ Concrete Floor
_____ Containment system (sump, for example)
_____ Roofed
_____ Dipping Vat
_____ Out in the Open

Please describe your fertilization program as completely as possible.

1. Fill in the chart below for permanent grass pasture used primarily for grazing only, not including fields planted in legumes or in mixed grass and legumes and not including hay fields.

Bahai or Other Grass?	Lbs. per Acre Nitrogen	Lbs. per Acre P_2O_5	Lbs. per Acre K_2O	Acres

2. Fill out the chart below for permanent grass fields usually cut for hay, not including fields in mixed grass and legumes or pure legumes.

Bahai or Other Grass?	Lbs. per Acre Nitrogen	Lbs. per Acre P_2O_5	Lbs. per Acre K_2O	Acres

3. Fill out the chart below for mixed grass and legume OR pure legume stands, used both for grazing and for cutting hay.

Mixed or Pure Stand?	Lbs. per Acre Nitrogen	Lbs. per Acre P_2O_5	Lbs. per Acre K_2O	Acres

Please describe any changes that you have made in your fertilization program since 1983.

4. Have you changed the total Nitrogen applied on any acreage?

Type of Pasture or Hay Field	Acres Affected	1983 Application Rate	1993 Application Rate

5. Have you changed the total P_2O_5 applied on any acreage?

Type of Pasture or Hay Field	Acres Affected	1983 Application Rate	1993 Application Rate

6. Have you changed the total K_2O applied on any acreage?

Type of Pasture or Hay Field	Acres Affected	1983 Application Rate	1993 Application Rate

We would like some information about other aspects of your farm or ranch management.

1. Do you irrigate any of your pasture or hay fields? _____ Yes _____ No

   If NO, go to Question 3.

   How many acres do you usually irrigate? _____ Acres

   How much water do you usually apply? _____

2. What is the primary source of water for your cattle during the rainy months? _____ Pumped _____ Surface water

   During which month or months of the year do you use this water supply? Put an "X" on those that apply.

Jn	Fb	Mr	Apr	May	Jun	Jul	Aug	Spt	Oct	Nov	Dec

3. What is the primary source of water for your cattle during the dry months? _____ Pumped _____ Surface water

   During which month or months of the year do you use this water supply? Put an "X" on those that apply.

Jn	Fb	Mr	Apr	May	Jun	Jul	Aug	Spt	Oct	Nov	Dec

4. Do you have a meter on any of your wells? _____ Yes _____ No

   If NO, go to Question 3.

   If YES, when was the first meter installed? _____ Year

   Does your local water management district monitor the amount of water that you use? _____ Yes _____ No

   About what percent of the time do you keep track of your water use?

   _____ Almost Always (more than 75% of the time)
   _____ Usually (50 - 75% of the time)
   _____ Sometimes (25 - 49% of the time)
   _____ Rarely (less than 25% of the time)

5. Do you have any ground water monitoring wells on your property? _____ Yes _____ No

   If NO, go to Question 4.

   When were the wells installed? _____ Year

   About how often are samples from the wells analyzed? _____ Times per year

6. Do you ever take samples from surface waters (canals, sinkholes, etc.) on your property and have them analyzed? _____ No
_____ Yes.
How often?_____

7. About what percentage of the time do you keep any of the following kinds of records?

Record	Almost Always More than 75% of the Time	Usually 50 - 75% of the Time	Sometimes 25 - 49% of the Time	Rarely Less than 25% of the Time
Soil test results				
Fertilizer application to pasture or hay fields, by field				
Nutrient content of pasture or hay fields				
Yield of pasture or hay fields, by field				

Finally, we have two questions about the future of your farm or ranch.

1. How important are the following factors for the future of ranching in Florida?

Factor	Very Important	Important	Not Very Important	Not At All Important
Decreasing beef consumption in the US				
Foreign beef production				
Pressure from animal rights groups				
Rising land values				
Rising property taxes				
Availability of labor				
Government regulations about land use				
Government environmental regulations				
Government labor regulations				

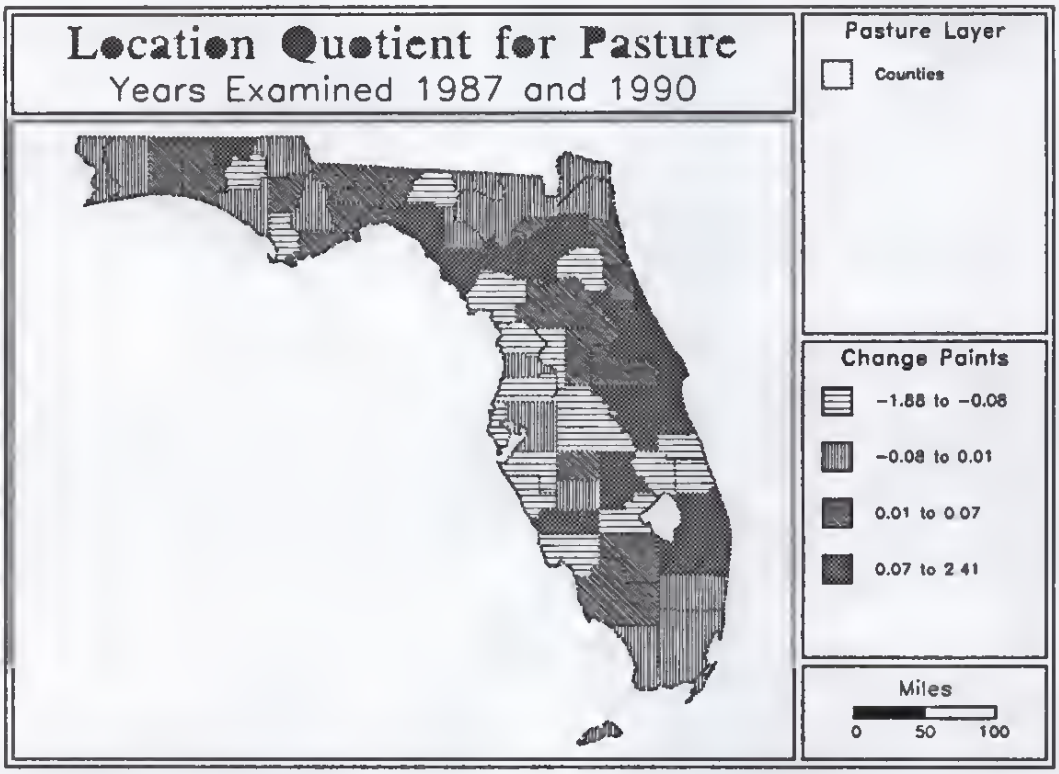
2. How important are the following factors to the profitability of your ranch or farm?

Factor	Very Important	Imporant	Not Very Important	Not At All Important
Beef prices				
Labor costs				
Costs of inputs like fertilizer				
Cost of veterinarian care				
Cost of equipment				
Interest rates				
Investments required to meet environmental safety standards				
Cost of keeping records for the government				

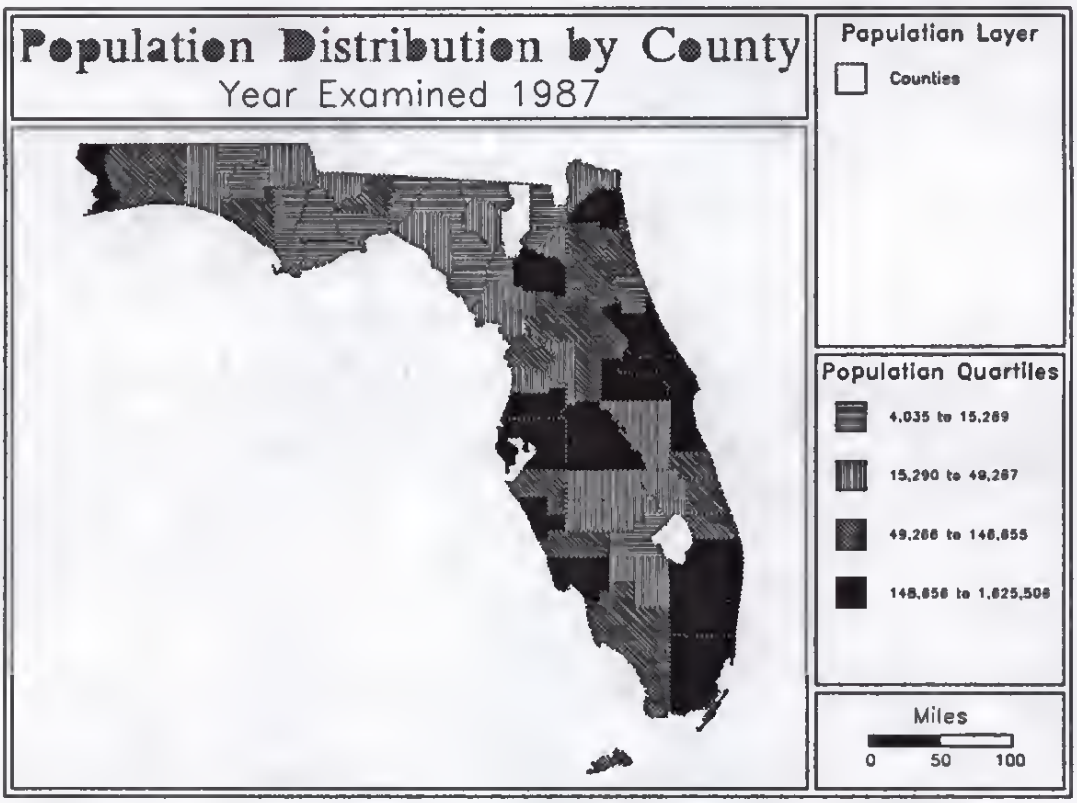
3. What percentage of your family income comes from each of the following sources today and what percentage came from these sources in 1983?

Source of Income	% in 1983	% in 1993
Off farm employment		
Your cattle operation		
Other farming activities		

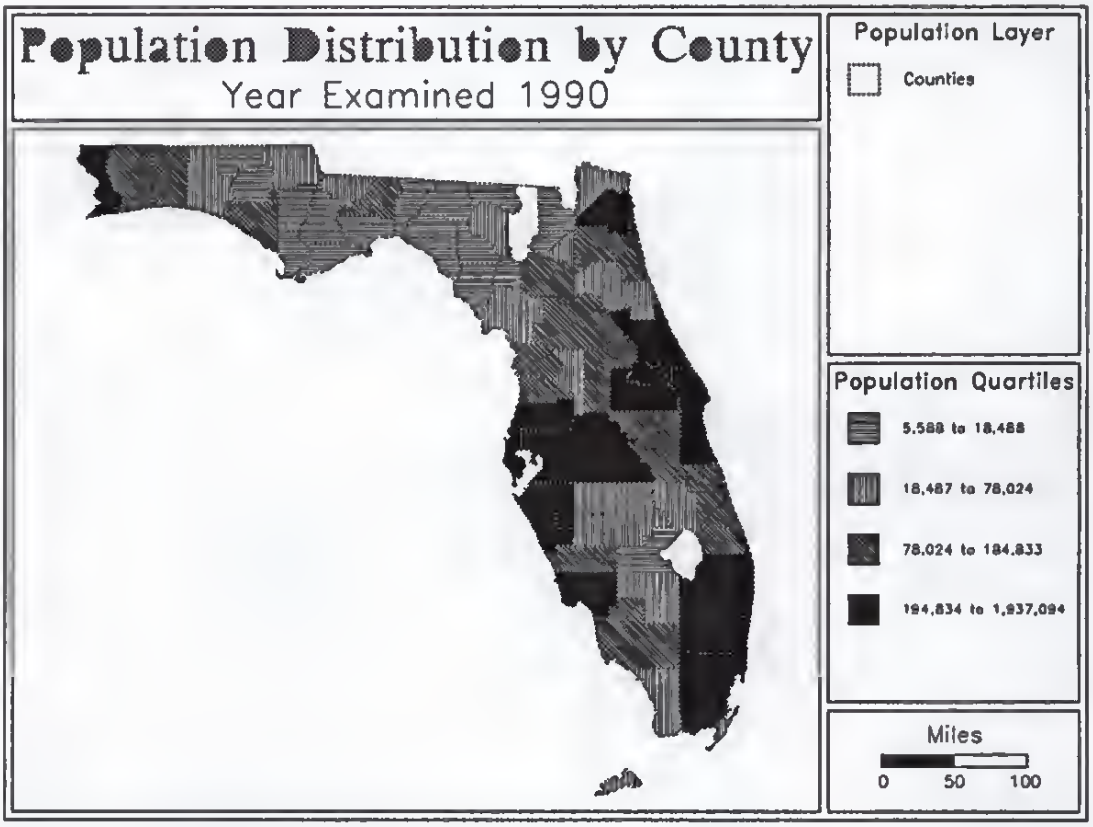
APPENDIX II
ADDITIONAL SURVEY RESULTS



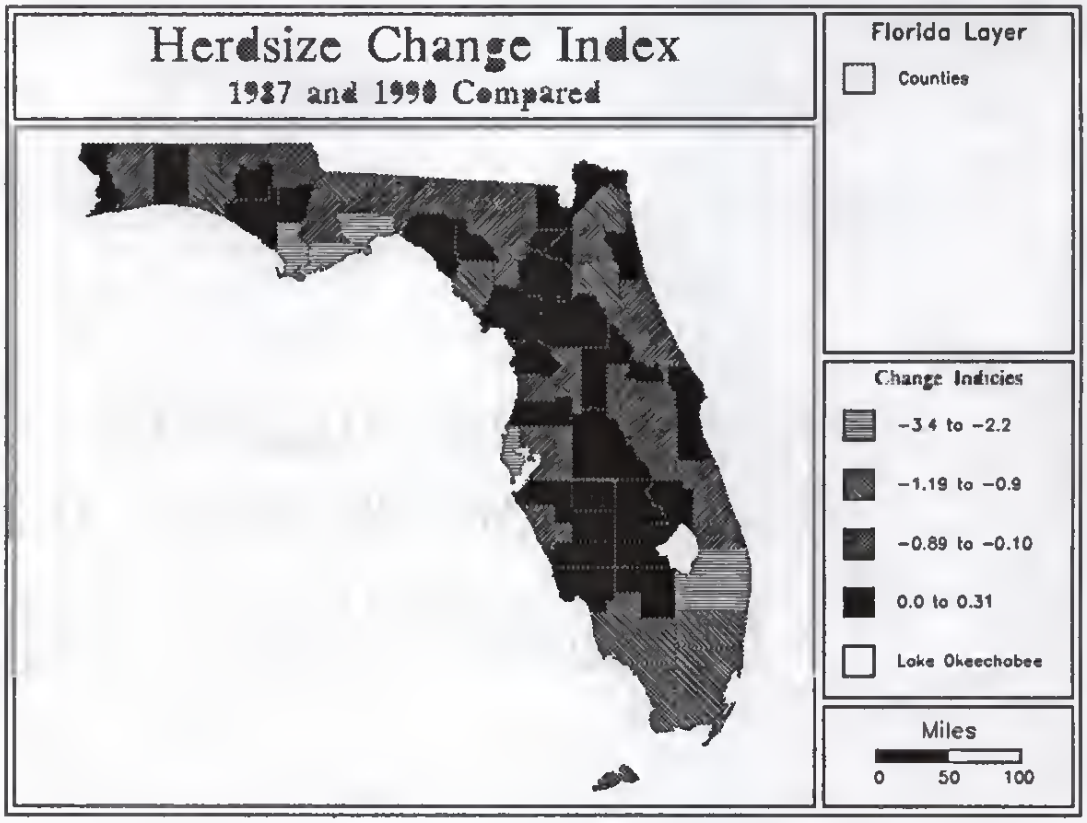
Differences between the LQ of 1987 and 1990.



Florida population by county in 1987. Source: Florida Abstract, 1987.



Population distribution by county in 1990. Source: Florida Abstract, 1990.



Herdsize change index differences between 1987 and 1990.

BIOGRAPHICAL SKETCH

Darryl Keith Clare, the second born of three children, was born in Harlem, New York, on August 8, 1951, to Mr. George and Mrs. Doris Clare. He received his primary school education in Harlem, at Saint Charles Borrowmeo Elementary School, and secondary school education at De Witt Clinton High School in the Bronx and post-secondary education at Carolina Military Academy in Maxton, North Carolina. In 1982 he graduated from Saint Mary's College in Moraga, California with a bachelor's degree in business management. He pursued a master's degree at the University of Florida after working two and a half years in Zomba, Malawi, as a secondary school math teacher. In 1990 he was awarded the Master of Arts degree in Urban and Regional Planning. His urban and regional planning research led him to the slums (favelas) of Rio de Janeiro, Brazil. While there, he learned conversational Portuguese, and presented his findings in Rio de Janeiro and Belo Horizonte. He then returned to the University of Florida to pursue a doctorate degree. He has pursued his course work in Geography with his minor in Urban and Regional Planning.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Cesar N. Caviedes, Chairman
Professor of Geography

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Timothy J. Fik
Associate Professor of Geography

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Joann Mossa
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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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William L. Weismantel
Professor of Urban and Regional Planning

This dissertation was submitted to the Graduate Faculty of the Department of Geography, in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August, 1996

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